Matrix Researched: Towards Full(er) Integration in Mixed Methods and Multiple Methods Research Via a Meta-Matrix Approach[1]

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Abstract
In this arts-based mixed methodological article, a movie script—the first in a series of movie scripts—is used to dramatize the journey of Ynot, an alias used by Professor Anthony J. Onwuegbuzie, as he navigates his first day of unemployment after his forced early retirement from full-time academia. Ynot embarks on a journey to demonstrate the power of integrating an array of qualitative and quantitative research approaches, methodologies, philosophies, methods, techniques, concepts, language, modes, disciplines, fields, and/or teams within a single study. Inspired by superheroes HalleBerryus and Mixedmethodus, Ynot aims to save the research world from paradigm wars and methodological purism through the extensive use of the Inter-Respondent Matrix. This Matrix is a tool for achieving a full(er) integration of research elements from the onset of studies, conceptualized by Onwuegbuzie (2017) as the 1 + 1 = 1 integration approach. The story is set in a cinema where two lifelong friends, Nilep and Ellah, excitedly await the screening of "Matrix Researched." The narrative weaves through Ynot's realization of his mission, encounters with HalleBerryus and Mixedmethodus, and their guidance towards utilizing the Matrix for fully integrating research methodologies. Alongside the narrative, the article delves into the historical and theoretical underpinnings of matrices in research, demonstrating their application across various fields, disciplines, cultures, and eras. The Matrix is portrayed as a versatile and powerful tool, not just in quantitative and qualitative research, but also in bridging the gap between them via fully integrated mixed methods research. Ynot's journey symbolizes the potential for researchers to navigate and to integrate diverse research elements to enhance the robustness and depth of their investigations. The superheroes' guidance emphasizes the significance of open-mindedness and creativity in research endeavors, encouraging a shift towards not only a mixed methodological way of thinking but also a full(er) integration way of thinking. Ynot, HalleBerryus, and Mixedmethodus stand united in advocating for a more inclusive and integrated approach to research, highlighting the benefits of fully integrating qualitative and quantitative elements for a more comprehensive understanding of complex and complicated research questions. The use of the Matrix, both as a metaphor and a practical tool, serves as a central theme, illustrating the transformative power of mixed methods research in overcoming traditional barriers stemming from a monomethod way of thinking and fostering innovation and insight in academic inquiry.

Keywords: matrix, matrices, inter-respondent matrix, arts-based mixed methodological article, 1 + 1 = 1 integration approach, 1 + 1 = 3 integration approach, meta-methods research, mixed methodological way of thinking, monomethod way of thinking

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Matrix Researched: Towards Full(er) Integration in Mixed Methods and Multiple Methods Research Via a Meta-Matrix Approach

The cinema was dimly lit, with the soft glow of the screen casting shadows across the faces of the audience. In the center of this multicultural tapestry of moviegoers, two women who were best friends, Nilep and Ellah, sat side by side, their friendship palpable in the air. They shared a large bucket of popcorn, intermittently reaching in to grab a handful, their attention occasionally diverted from the screen to exchange excited whispers about the upcoming movie.

Ellah, a woman from the United States, who had been divorced three times, and who had two children, wears a look of anticipation, her eyes sparkling in the low light as she eagerly awaits the start of the movie, “Matrix Researched: Towards Full(er) Integration in Mixed Methods and Multiple Methods Research Via a Meta-Matrix Approach.” Sitting very close to her was Nilep, a single woman from Turkey, sporting an engagement ring on her left hand, her own excitement matching that of Ellah.

Nilep, with her vibrant personality mirrored in her expressive attire, leaned in, sharing a joke about the last preview they had watched, causing Ellah to laugh, her joy infectious. Their easy camaraderie and laughter filled their immediate vicinity, drawing smiles from nearby attendees. Despite the academic title of the movie, their enthusiasm was undimmed, a testament to their shared interest in complex narratives and innovative research methodologies.

The cinema, a haven for diverse stories and audiences, buzzed with the energy of eager anticipation. Men and women of various backgrounds filled the seats, the soft murmur of their conversations creating a background hum that was both comforting and expectant. The last of

the previews faded out, giving way to the final commercial. This commercial loudly proclaimed a message about mixed methods research, accompanied by a striking image, as follows:

"Maximize Meaningful Insights with the '1 + 1 = 1 Integration Approach' in Mixed Methods Research!"

Ellah, leaning over to Nilep, with a sparkle in her eye, stated:

> "1 + 1 = 1? I recall also that the late prolific Professor Michael Fetters and his talented co-author Professor Dawn Freshwater in 2015 promoted the formula '1 + 1 = 3.' It's clear that mixed methods researchers can't count!"

Nilep chuckles, her eyes twinkling with amusement. She responded sarcastically,

> "If I recall correctly, when I was in primary school, my favorite teacher taught me that 1 + 1 = …"

Before Nilep could finish her sentence, the commercial cuts her off with a clarifying voice-over.

> "In the '1 + 1 = 1' integration approach, the '1' stands for Integration, which, in turn, in the words of Onwuegbuzie and Hitchcock (2022, p. 598), stands for 'the optimal mixing, combining, blending, amalgamating, incorporating, joining, linking, merging, consolidating, or unifying of research approaches, methodologies, philosophies, methods, techniques, concepts, language, modes, disciplines, fields, and/or teams within a single study.'"

Next, the following text flashed boldly:

SO, USE THE "1 + 1 = 1" INTEGRATION APPROACH—OTHERWISE KNOWN AS THE META-METHODS RESEARCH APPROACH—TODAY!

Nilep and Ellah looked at each other, their expressions a mixture of amusement and excitement, then turned their attention back to the screen, as the commercial ended. The screen went dark for a moment, heightening the anticipation in the room. The opening credits began to roll, signalling the start of the movie. Then, the title "Matrix Researched: Towards Full(er) Integration in Mixed Methods and Multiple Methods Research Via a Meta-Matrix Approach" appeared, and the cinema fell silent, every pair of eyes fixed on the screen, ready to be transported into a world where academic inquiry meets cinematic storytelling. Nilep and Ellah, best friends united by their love for groundbreaking narratives, shared a quick look, their smiles reflecting their readiness for the journey ahead. This journey into the depths of research methodologies and their cinematic exploration was about to begin, promising an enlightening experience for these two friends and the remainder of the audience.

Dialectical Publishing

Presents…

DECEMBER 31, 2023……..SOMEWHERE IN NEW CROSS GATE, LONDON…….

Professor Onwuegbuzie, who went under the mixed methods alias, Ynot, was a senior research associate at the University of Cambridge, whose was working his last day at the University because his 5-year contract was due to expire on the last day of the year. Over the last 2 years, in anticipation of his contract expiring, Ynot had attempted to secure dozens of academic positions all over the world—from the United Kingdom to Africa to Australia to Canada to the United States to the Caribbean. However, he found no institution willing to employ him, despite securing the publication of nearly 600 works; being cited in more than 114,000 works; securing a h-index of 112; delivering more than 70 keynote addresses worldwide; and holding top rankings within the field of Education—#1 in the United Kingdom, #1 in Africa, #2 in Europe, and #11 globally—as well as being #84 globally in the Social Sciences and Humanities, not to mention being the world's #1 most cited Educational Research Scientist based on citation count over the past 6 years, and receiving accolades such as the 2022 Research.com Social Sciences and Humanities Leader Award in the United Kingdom, the 2023 counterpart in the United States, and the 2023 Best Researcher Award at the International Academic Awards. To add further context, Ynot resided in the United Kingdom, a country where only a meager 1% of full professors at universities are Black (Lough, 2022), highlighting a significant disparity in the academic landscape—with Kehinde Andrews, Professor of Black Studies at Birmingham City University, noting that rather than universities being "progressive dreamlands," the "make-up of professors is the perfect reflection of the narrow Eurocentric views still produced by universities" and "I have seen very few genuine attempts to address the issues of racism at any level across the sector" (Coughlan, 2021, paras. 13-14). Consequently, he came to the painful conclusion that his academic career had culminated in stark failure, leaving him feeling like an utter failure!

On learning about Ynot's harrowing situation, the audience was enveloped in a profound mix of sorrow and empathy—especially the audience members of color—with some of their eyes glistening with tears as they were moved by his adversity.

Plagued by a string of professional search failures, Ynot was driven to the drastic measure of an untimely forced early retirement from the world of full-time academia. Standing at a daunting crossroads of his professional life, with the path ahead shrouded in uncertainty, he forwent the festivities of New Year's Eve. Instead of celebrating the New Year, he surrendered to the solitude of an early bedtime, wrestling with the harrowing reality that the dawn of the New Year would strip him of his employment, deprive him of his livelihood, and, most crushingly, maroon him in a sea of failure, feeling utterly unvalued, discarded, and profoundly rejected.

It took him a very long time to get to sleep. As he lay in bed, he tossed and turned for what seemed to him like several hours. Instead of counting sheep, he decided to recite Onwuegbuzie's (2017) and Onwuegbuzie and Hitchcock's (2019) integration formula, muttering the following:

1 + 1 = 1... 1 + 1 = 1... 1 + 1 = 1...

He repeated the formula like a mantra, his frustration growing with each passing moment. Finally, his eyes closed, and he drifted into a deep sleep. Ynot was sleeping peacefully now, his breathing deep and even. Suddenly, a faint but urgent voice disrupted the silence:

Ynot, wake up! Wake up!

Ynot jerked awake, his eyes wide with confusion. He looked around, attempting to discern reality from dream. Whispering to himself, he asked,

Am I dreaming? Am I hearing things?

The voice calls out again, even more urgently this time:

Ynot, wake up! Wake up!

This second call prompted Ynot to sit up in bed. His mind began to work overtime. He asked himself, "Who is calling my name? How did this person get into my bedroom? Why?" Suddenly, from the darkest corner of Ynot's bedroom, a figure emerged. This was not any ordinary person; the person—taking the form of a woman—was dressed in an elaborate superhero attire, complete with a cape that appeared to flutter slightly despite the absence of any breeze in his bedroom. An ethereal glow surrounded her, casting a soft light that seemed to push the shadows away, making the room feel less cold and more filled with an otherworldly presence. Her attire made her look both majestic and mysterious. She glided to the foot of Ynot's bed, standing tall and imposing yet radiating a sense of warmth and safety. With a voice that exuded both strength and gentleness, she stated in a soft but firm voice:

Ynot, fear not. I come as a friend, a guide, and a protector.

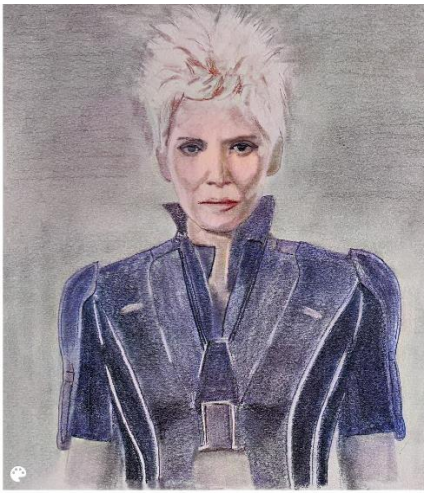
Ynot found himself transfixed by her presence, his initial fear gradually blending into a mix of curiosity and awe. With his heart pounding in his chest, Ynot mustered the courage to voice the following questions aloud:

Who…who are you? What do you want?

The figure, cloaked in superhero attire and emitting a captivating aura of beauty, smiled softly, a gesture that appeared to light up the room. She replied with a voice that carried the weight of the world:

My name is HalleBerryus! It is not what *I* want that matters but what the *World* needs! I am here because *you* are needed, Ynot. The world outside is facing methodological challenges that only *you* can help overcome. You are needed to help save the world!

Your journey begins tonight.



Ynot stared in disbelief, trying desperately to process the words. The weight of the message began to dawn on him. Breathlessly, he asked:

Why me?

HalleBerryus stepped closer, her presence both comforting and intimidating. She replied,

(Wh)Ynot?

Ynot looked at HalleBerryus, a mix of fear and bemusement in his eyes. He realized that his professional life was about to change forever. Ynot asked:

What do you need me to do to save the world?

Ynot's bedroom was dimly lit, shadows clinging to the corners. Ynot, looking puzzled and apprehensive, sat up in his bed and stared at HalleBerryus, who exuded calmness and authority. In her hands resided a choice that would change everything for Ynot: one red pill and one blue pill. HalleBerryus put the red pill in Ynot's right hand and the blue pill in Ynot's left hand. Looking at Ynot's left hand, she gravely stated:

This is your one and only chance, Ynot. After this, there is no turning back. You take the blue pill—the story ends, you will awaken in your bed, free to hold onto any belief you cherish. In the morning, you can then just initiate payment of your unemployment cheque and continue perpetuating a life shrouded in professional obscurity.

HalleBerryus shifted her gaze to Ynot's right hand.

You take the red pill—you stay in Wonderland, and I show you how deep the rabbit hole goes.

Ynot hesitated, his gaze shifting between the two pills and HalleBerryus's piercing eyes. The choice weighed heavily on him, the promise of truth against the comfort of ignorance. Ynot, stated with much uncertainty:

Is this it? Just a choice between these pills?

HalleBerryus nods and admits:

All I am offering you is the truth—nothing more, nothing less.

A big heartbeat. Then, Ynot reached a decision. He raised towards his mouth his right hand that held the red pill, his resolve hardening. HalleBerryus nodded approvingly, a hint of a smile playing on her lips.

HalleBerryus continued….

Remember... all I am offering you is the truth!

Ynot swallowed the red pill and then handed the blue pill back to HalleBerryus. His bedroom seemed to stand still for a moment, the weight of his choice settling in. HalleBerryus stood, extending her hand to Ynot. With warmth, HalleBerryus declared:

Welcome to the real world!

This pivotal moment encapsulated Ynot's decision to embrace the unknown and to pursue the truth, setting the course for his journey and the unfolding story of "The Matrix Researched."

Meanwhile, back at the cinema, Nelip and Ellah are utterly engrossed, their gazes fixed intently on the screen, captivated by the unfolding story.

HalleBerryus responded:

Now that you have taken the red pill, I need you to show the world the power of the Matrix for integrating quantitative and qualitative research approaches in mixed methods research.

With a quizzical look, Ynot asked pensively:

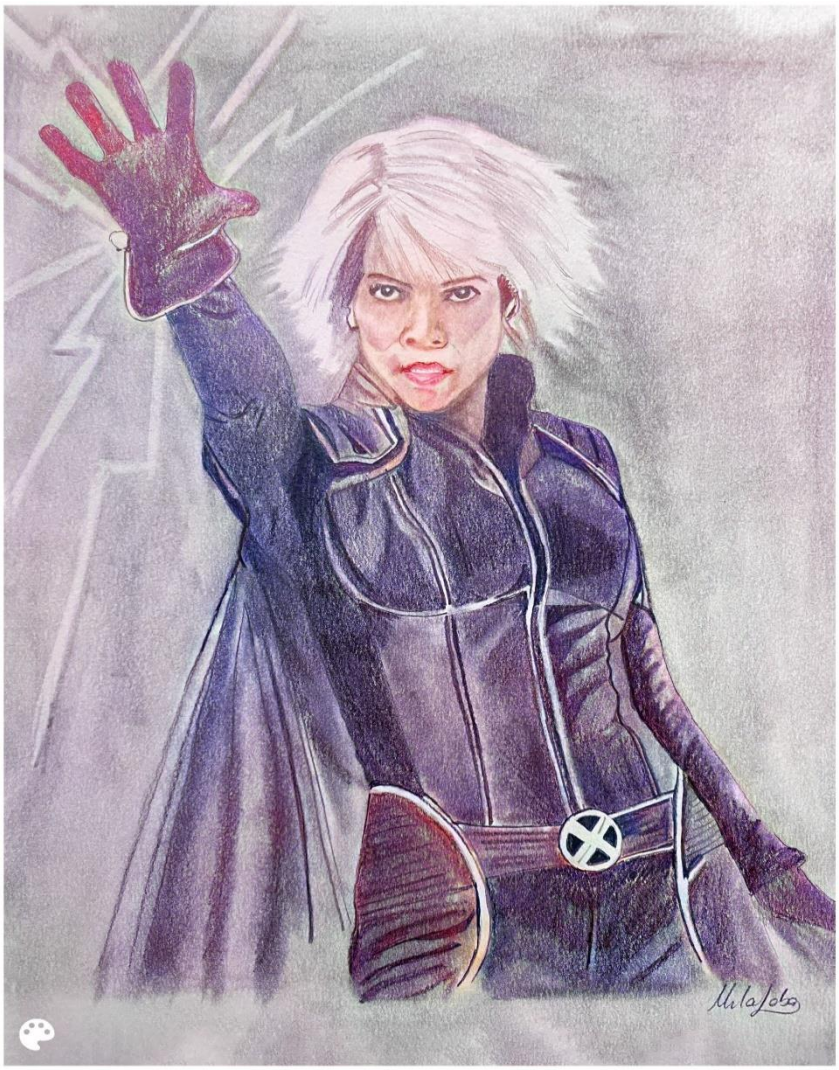
What is the Matrix?

On asking this question, Ynot arose from his bed and stood in the center of his bedroom, anticipation and uncertainty reflected in his eyes. HalleBerryus, a figure of strength and beauty, stood before him. She raised her arms, her fingers extended towards the ceiling in a

deliberate, commanding gesture. With a powerful, resonant voice, HalleBerryus uttered the following word:

Behold!

As her fingers pointed upwards, the room was suddenly filled with a sound, a deep, thrumming note that vibrated through the air. A flash of light erupted from above, blindingly bright, enveloping the room in its brilliance.



As the light faded, a second superhero figure stepped forward from where the light had been its brightest. This man, dressed in superhero attire markedly different from that of HalleBerryus, carried with him a celestial glow that bathed the room in a soft, warm light, casting away the shadows and filling the space with even more of a radiant, otherworldly atmosphere. Ynot gazed in awe as the handsome male figure stood tall, an aura of undeniable authority emanating from him. The bedroom now felt transformed, as if the very essence of heroism and power had permeated its walls. Ynot, moved by the presence and words of the two superheroes, felt a surge of courage and purpose.

With a voice that commanded attention, yet carrying an undertone of warmth, the male superhero stated:

Hi Ynot. My name is Mixedmethodus. In times of darkness, when hope seems but a flicker, HalleBerryus and I are the bearers of light, the champions of the dawn. With your assistance, the three of us hold the power to change the course of methodological destiny.

For now, I am here to explain the power of the Matrix to you.

Ynot, stood across from Mixedmethodus, a figure shrouded in mystery. The revelation that Mixedmethodus just made hung heavily between them. Ynot, stunned by the statement of Mixedmethodus, in a voice that carried a weight of urgency, seeking clarity amidst the turmoil of his thoughts, asked him the following question:

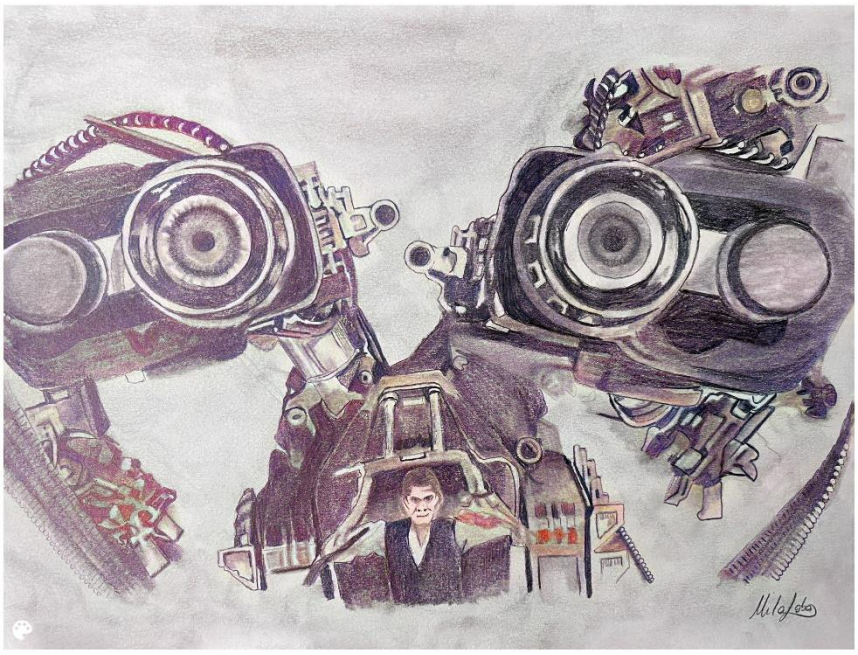
But I thought the Matrix was evil?

Mixedmethodus, poised to respond, the air around them seemingly pulsating with the importance of his forthcoming explanation:

Yes, in the Fourth Industrial Revolution, also called 4IR, the Matrix was evil! As stated by Klaus Schwab, engineer, economist and founder of the World Economic Forum, 4IR is "a fusion of technologies that blur the lines between the physical, digital, and biological spheres." Under 4IR, the Matrix was a computer-generated dream world designed to keep humans under control. Humans were kept sedated, effectively living a virtual life. Our team members, *Morpheus* (Captain of the Nebuchadnezzar, a ship in the real world) and *Trinity* (skilled and dedicated member of Morpheus's crew), alongside *Neo* (Thomas A. Anderson; the protagonist, like you, Ynot), shared a unified goal to free humanity from the enslavement of the Matrix.

Mixedmethodus continued:

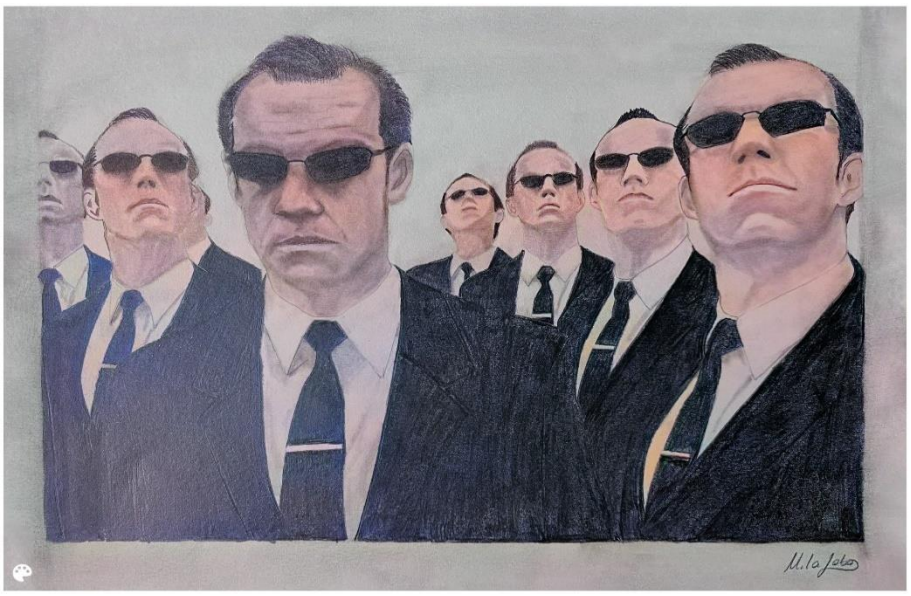
Morpheus, Trinity, and Neo had to work extremely hard to awaken individuals from the simulated reality of the Matrix and to recruit them to their cause, expanding the resistance movement operating from Zion, the last human city in the real world. Their overarching goal was to battle the machines that maintained the Matrix and oppressed humanity, aiming to end their dominance and to secure freedom for humans.



Mixedmethodus paused, his expression one of deep respect for the trio's efforts. With regret, Mixedmethodus revealed the following:

Unfortunately, Neo had to battle with Agent Smith many times. Agent Smith was a powerful artificial intelligence program created to keep order within the system by eliminating any threats posed by humans aware of the Matrix's true nature, as well as those seeking to free others from the simulation. After his initial

destruction by Neo, Agent Smith developed new powers, having a unique ability to replicate himself by assimilating other entities within the Matrix, both programs and human avatars. Agent Smith had a personal vendetta against Neo. Agent Smith's evolution from a system enforcer to an existential threat to both machines and humans underscores the complex dynamics of power, control, and resistance that define the "Matrix" universe.



Mixedmethodus's voice softens, the tale nearing its end.

Neo negotiated with the machines, offering to defeat Agent Smith—who had become a threat to both the Matrix and the real world—in exchange for peace between humans and machines. The battle between Neo and Agent Smith was not just physical but also philosophical, reflecting broader themes of free will versus determinism, the nature of reality, and the struggle for liberation from oppressive systems. Neo fought Agent Smith in the Matrix and ultimately allowed himself to be assimilated, which led to the destruction of Agent Smith through a connection to the Source (the machine mainframe). This act resulted in Neo's death in the real world.

With a cautious optimism, Mixedmethodus explained:

The machines eventually withdrew their attack on Zion, honoring the agreement made with Neo. A ceasefire was established. The Architect (the creator of the Matrix) and the Oracle (a program that sought to help humans) discussed the new terms of peace, thereby allowing humans the choice to remain in the Matrix with full awareness of its nature or to live freely in the real world. The Oracle expressed her belief that those who wanted

to be freed from the Matrix would be given the chance, and she was hopeful about the future—hopeful for a new era of potential harmony between humans and machines, rather than an outright victory for either side.

The atmosphere was thick with anticipation as Mixedmethodus prepared to fast forward to the present day. Ynot waited, his posture tense, his eyes locked on Mixedmethodus, hungry for the forthcoming revelation. With a solemn gravity, Mixedmethodus stated,

Allow me to elucidate further...

He stepped closer, the seriousness of his tone demanding undivided attention. The bedroom air seemed to still, as if the very fabric of reality was bracing for the impact of his words. Mixedmethodus gestured with his hands, his movements deliberate, as he began to weave the threads of his explanation into a tapestry of understanding, each word carefully chosen to enlighten and to inform:

…But since 27th April 2022, humans have been living in the Fifth Industrial Revolution, or 5IR. 5IR adds a human touch to 4IR, involving the use of advanced technologies in a human-centric way. Under 5IR, the Matrix is a human-friendly place. 5IR embodies Artificial Intelligence (AI), Big Data, and the Internet of Things (IoT), but incorporates greater human intelligence. Most importantly, the Matrix has the potential to improve significantly the quality of research by promoting the full(er) integration of quantitative and qualitative research approaches—what you and the very impressive Dr. John Hitchcock refer to as the 1 + 1 = 1 integration approach or, more simply, as a meta-methods research approach. Let us show you how…

As soon as the words of Mixedmethodus, “Let us show you how,” lingered in the air, HalleBerryus, with a look of determination, sprung into action. She raised her arms, her fingers splayed out, for a second time, pointing towards the ceiling in a powerful, commanding gesture. The room’s ambiance shifted dramatically. A sound, deep and resonant, filled the space, vibrating through every corner. Then, a flash of light burst forth from above, blindingly bright, transforming the room into a realm of pure brilliance.

As the light dimmed, Ynot’s bedroom transformed yet again. Where once there was only the trappings of a bedroom, now stood a very large screen, illuminated and ready. The screen flickered to life, revealing the title, “History of the Matrix,” set against a backdrop of slick,

professionally designed PowerPoint slides, complete with bullet points, fancy graphics, and captivating images. Turning to face the screen, Mixedmethodus stated with enthusiasm:

Let's delve into the History of the Matrix...

He gestured towards the screen, each slide change synchronized with his narration. Ynot's bedroom, once ordinary, now hosted an epic tale of knowledge and discovery, as Mixedmethodus guided Ynot through the intricacies of the origin of the Matrix, as follows:

Slide 1: History of the Matrix

- The Matrix can be traced back to ancient civilizations.
  - e.g., China and India
- At least 17 centuries before
  - the third industrial revolution (3IR; digital revolution; 1969-2000)
  - the fourth industrial revolution (4IR; digitalization; 2000-)
  - Neo, Morpheus, and Trinity of The Matrix
- In ancient China, the Chinese mathematician Liu Hui (around the 3rd century) used a form of Matrix notation to solve systems of linear equations.
- In ancient India, mathematicians like Brahmagupta (7th century) and Bhaskara II (12th century) used Matrix-like structures for solving simultaneous equations.

Slide 2: History of the Matrix (Cont/d…)

- In ancient Egypt, the Rhind Mathematical Papyrus (around 1550 BCE) includes examples of linear equations that can be interpreted as matrix equations.
- Similarly, the ancient Babylonians (around 1800 BCE) used linear systems that can be seen as early matrix operations.

Slide 3: History of the Matrix (Cont/d…)

- The formal development of Matrix algebra began in the 19th century with mathematicians such as
  - Arthur Cayley
  - James Joseph Sylvester
  - William Rowan Hamilton
- Cayley made significant contributions to the theory of matrices and their algebraic properties.
- Cayley introduced the term "matrix" in 1858 to describe a rectangular array of numbers

Slide 4: History of the Matrix (Cont/d…)

- In the early 20th century, further advancements in matrix algebra were made by mathematicians like
  - David Hilbert
  - Ernst Steinitz
- They developed more rigorous mathematical foundations and expanded the scope of matrix algebra in various areas of mathematics and applications.

After presenting this fourth slide, Mixedmethodus stated:

HalleBerryus, the floor is yours.

HalleBerryus nodded, accepting the remote with a determined look. She faced Ynot, clicking the remote. The screen transitioned to a new section of slides. She stated,

Thank you, Mixedmethodus. In this set of slides, I will discuss the role that The Matrix has had and continues to have for the field of quantitative research.

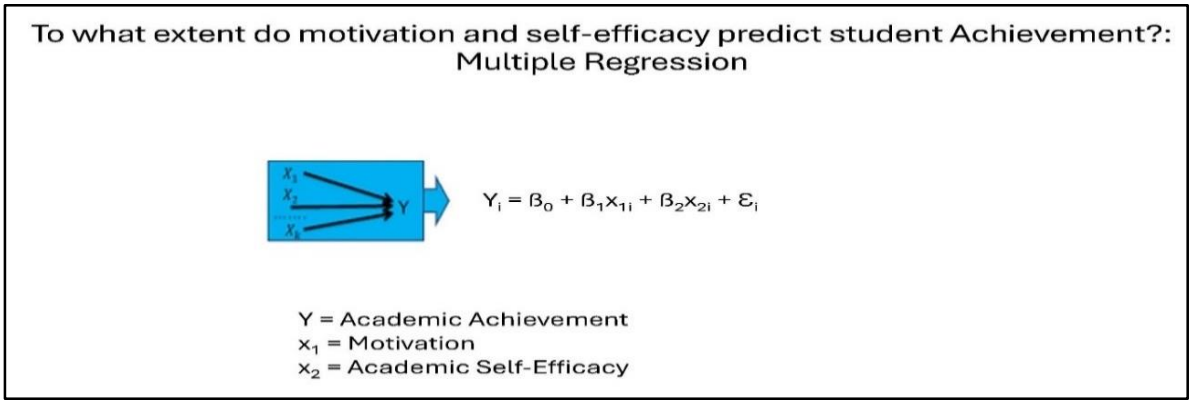
The screen now displayed a slide entitled, “Matrix Use in Quantitative Research.” HalleBerryus pointed to the screen with a laser pointer, highlighting the title. HalleBerryus explained,

As we venture into the realm of quantitative research, it is crucial to understand the pivotal role that the Matrix plays.

Ynot was maximally attentive, his eyes fixed on HalleBerryus as she begun to elaborate, her voice filled with passion and expertise. HalleBerryus clicked to the next slide, stating the following:

Let us suppose we were interested in determining the extent to which two quantitative variables, motivation and self-efficacy (i.e., independent variables), predict another quantitative variable, student achievement (i.e., dependent variable). Let us also suppose that all three variables are continuous and normally distributed, specifically, all representing interval scale measurement. Then, a multiple regression analysis could be used, as the following slide indicates:

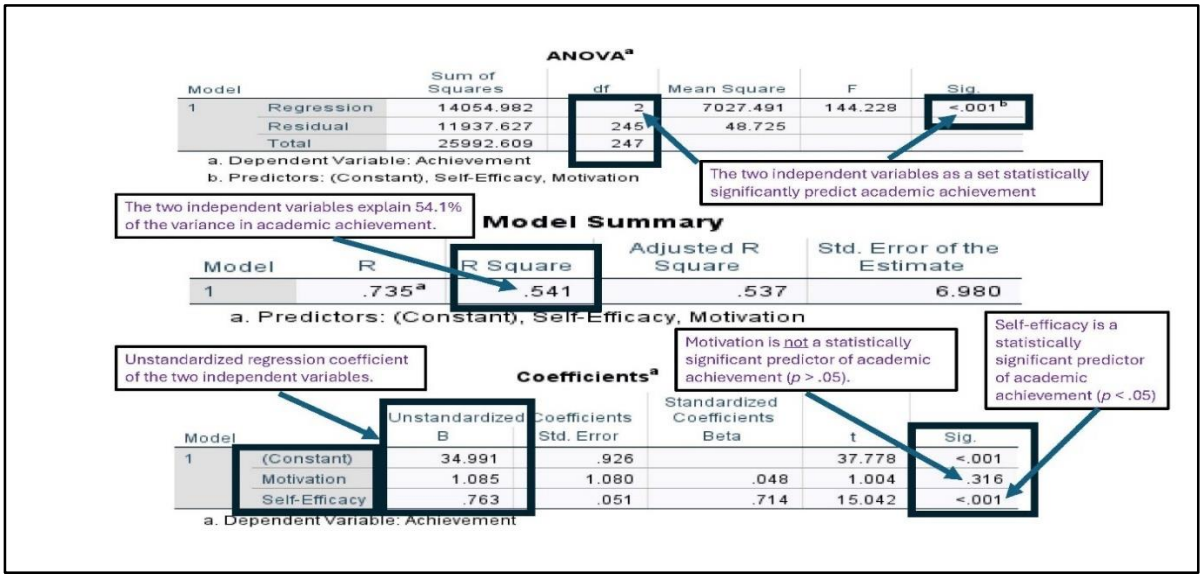
Slide 5: Heuristic Example of a Research Question that Justifies Multiple Regression

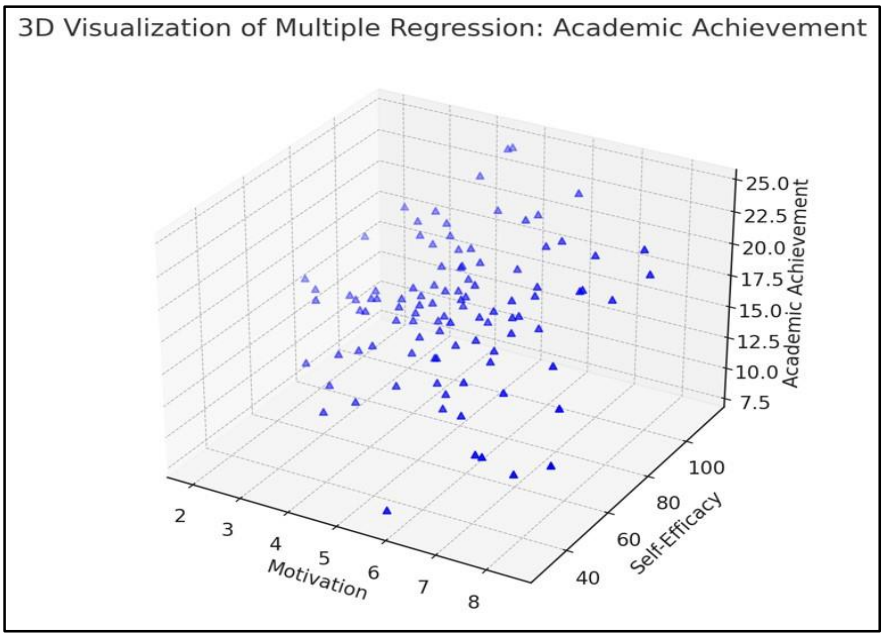


HalleBerryus continued…

Now, we used real data collected on 247 college students on whom academic achievement (i.e., examination score), levels of student motivation (i.e., measured via a motivation scale), and levels of academic self-efficacy (i.e., measured via a motivation scale) were measured. Three sets of tables from the multiple regression analysis are presented below. We see from the first table that, as a group, the two independent variables statistically significantly ($p < .001$) predict academic achievement. The second table reveals that, as a set, the two independent variables explain 54.1% of the variance in academic achievement. Finally, the third table reveals that, whereas motivation is *not* a statistically significant predictor of academic achievement ($p = .316$), self-efficacy is a statistically significant predictor of academic achievement ($p < .001$).

Slide 6: Output from a Multiple Regression Analysis





With a commanding presence that seemed to illuminate the room, HalleBerryus continued, her voice resonating with an authority that commanded attention yet carried the warmth of a guiding mentor. Her eyes sparkled with an intensity that reflected her deep commitment to the mission at hand and, as she spoke, it was as if the very essence of knowledge and wisdom flowed from her words. Each syllable was weighted with the gravity of their collective purpose; yet, her delivery remained graceful, weaving complex ideas into a tapestry that was both inspiring and accessible:

The teaching of college-level statistics has evolved significantly over the years, influenced by technological advancements, shifts in pedagogical approaches, and the changing demands of various fields. In particular, over the years, pedagogically, there has been a shift from an emphasis largely on theoretical foundations, with a strong focus on mathematical underpinnings, to a greater emphasis on applied statistics—with courses designed to equip students with skills to analyze and to interpret data in practical, real-world scenarios, reflecting the increasing importance of data-driven, decision-making across disciplines.

HalleBerryus stood in the center of the room, the weight of the moment palpable in the air. She hesitated, her shoulders rising and falling with a deep, measured breath. The silence stretched, heavy with anticipation. With a voice tinged with sorrow and regret, she announced:

It is with a heavy heart that I must reveal...

Her words trail off for a moment, as if the pain of what she was about to disclose was almost too much to bear. She gathered herself, determined to convey the truth, no matter how difficult.

As a result, the vast majority of college students who take a statistics course have *no* idea that the Matrix plays a vital role in statistics. Unfortunately, moving away from teaching the role of the Matrix in statistics has yielded several drawbacks, including the following:

HalleBerryus then clicked to the next slide, which displayed the following information:

Slide 7: Drawbacks of Moving Away from Teaching the Role of Matrices in Statistics

- **Limited Understanding of Underlying Mechanisms**
  - Without a solid grasp of matrices and their role in statistical computations, students might lack a deep understanding of how algorithms work. This knowledge is crucial for developing new methods or adapting existing ones to novel situations.
- **Reduced Analytical Skills**
  - Working with matrices enhances analytical thinking and problem-solving skills. Students not exposed to this aspect of statistics might miss out on developing these critical skills to their full potential.
- **Challenges in Understanding Computational Efficiency**
  - Understanding matrices and their operations is crucial for appreciating computational efficiency in data analysis, especially with large datasets. Without this knowledge, students might not fully understand the trade-offs in algorithm design or how to optimize computations.
- **Barriers to Interdisciplinary Collaboration**
  - Many fields involve the use of matrix notation and operations as a common language for discussing complex models and algorithms. Lack of familiarity with matrices could hinder effective communication and collaboration in interdisciplinary research teams.
- **Reliance on Software Without Critical Judgment**
  - When students are taught to rely heavily on software for statistical analysis without understanding the matrix operations that underlie these tools, they might be less equipped critically to evaluate the results—yielding a 'black box' mentality wherein results are accepted without question. This can lead to misinterpretation of data or misuse of statistical methods.
- **Reduced Ability to Innovate**
  - A deep understanding of matrices and their application in statistics often is necessary for innovation within a field. Students who are not proficient in these areas might be less likely to contribute novel solutions to statistical problems.

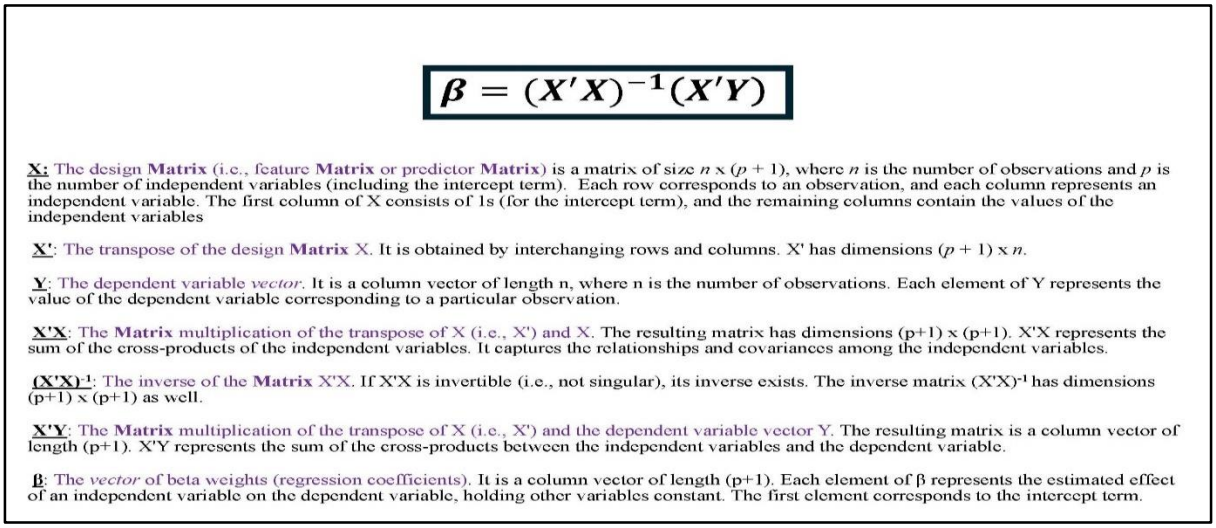
Ynot stood before the screen, absorbing the cascade of information. His simple nod, more than any words could, acknowledging the importance of the message conveyed by the slide. Momentarily, his bedroom was silent, save for the quiet hum of the projector, as the weight of the revelation settled in. After a few minutes, this moment of silence was broken by HalleBerryus, who continued with her discussion about the role of matrices in quantitative research.

Now returning to the multiple regression analysis in Slide 6, the regression coefficients in the third table are derived from a matrix equation—specifically, what is referred to as the Ordinary Least Squares (OLS) matrix equation. This famous equation is

$$\boldsymbol{\beta} = (\boldsymbol{X}'\boldsymbol{X})^{-1}(\boldsymbol{X}'\boldsymbol{Y})$$

This matrix equation is explained in the following slide.

Slide 8: Ordinary Least Squares (OLS) Matrix Equation



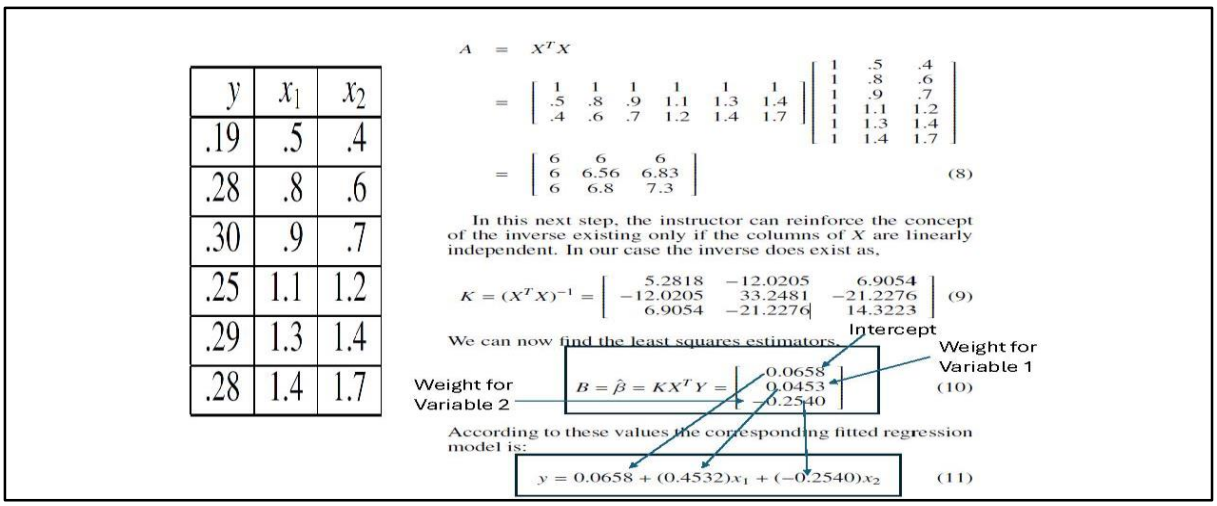
HalleBerryus gave Ynot a few moments to read this slide. Ynot leaned forward slightly, his gaze fixed on the screen. The slide before him was dense with information, but he navigated it with an experienced eye. As he read, a murmur escaped him, a sound of recognition and understanding. Under his breath, Ynot muttered,

Ah, of course...

He took a moment, letting the knowledge sink in, his mind connecting dots from his past experiences. Then, with a final nod to the slide, he turned to face HalleBerryus, his expression now one of readiness. This silent exchange, this look, served as the unspoken signal for HalleBerryus to proceed. She caught the cue effortlessly and nodded, acknowledging his understanding. Hence, she continued her explanation:

The next slide provides an example of how to use the OLS matrix equation to calculate multiple regression coefficients.

Slide 9: Demonstration of the Use of the Ordinary Least Squares (OLS) Matrix Equation



On seeing this slide (i.e., Slide 9), Ynot nodded in recognition. This slide triggered memories of the days when he took two mathematical statistics courses—among many other statistics courses—as part of his Master's of Science (M.S.) degree in Statistics at the University of South Carolina. These equations were a big part of these courses wherein, as students, they were given assignments that required them to calculate multiple regression coefficients armed with nothing but the OLS matrix equation and their calculators. Ynot displayed a slight smile on his lips as these memories came flooding back. The slide before him now was not just a collection of information, but a bridge to his past as a graduate student.

HallleBerryus continued:

The OLS matrix equation is the most popular and widely used matrix equation in multiple regression. The next slide explains why the OLS matrix equation is particularly useful:

Slide 10: Utility of the Ordinary Least Squares (OLS) Matrix Equation

- it provides a clear, interpretable model wherein each coefficient represents the expected change in the dependent variable for a one-unit change in the corresponding independent variable, holding all other variables constant.
- it allows for direct computation of the coefficients without the need for iterative optimization methods.
- it allows use of modern statistical software packages (e.g., R, Python's statsmodels, SPSS, SAS, STATA) in a user-friendly manner, making it accessible even to those with limited statistical backgrounds.
- it has a strong theoretical foundation, with assumptions that, when met, ensure the best linear unbiased estimates (BLUE) of the coefficients
- it helps analysts understand the underlying mathematics of regression analysis, including how the coefficients are influenced by changes in the independent variables and the geometry of linear transformations.
- it is used—via components of the equation, especially (X'X)—to assess the quality of the regression model, such as variance inflation factors (VIFs) for detecting multicollinearity.
- it lays the groundwork for more advanced topics in statistics, including generalized linear models, mixed models, and more. Understanding it enables a deeper comprehension of these more complex models.

HalleBerryus then pointed to the last bullet item on Slide 10, explaining the following:

The OLS matrix equation, which is foundational for multiple regression analysis, is part of a broader family of Matrix techniques that underpin many statistical methods. In fact, principles of the OLS matrix equation extend to various other general linear model (GLM) analyses and beyond, from correlation coefficients to independent samples *t* tests to analysis of variance (ANOVA) to multiple analysis of variance (MANOVA) to canonical correlation analysis to structural equation modeling (SEM) to hierarchical linear modeling (HLM). Examples of these matrices include the between-group variance Matrix, the within-group variance Matrix, the covariance Matrix of the observed variables, the covariance Matrix of the errors, and the variance-covariance Matrix. Although the specific mathematical formulations and tests (e.g., *t* tests, *F* tests) differ from the basic OLS regression model, they all share a common foundation in the use of a Matrix technique for estimating model parameters and for testing of hypotheses about those parameters. For example, MANOVA, which extends the ANOVA framework to handle multiple continuous dependent variables simultaneously, assesses the effect of independent categorical variables on these dependent variables. The model estimation in MANOVA can be understood in the context of generalized linear models, which involve the use of matrices for estimating coefficients. Although not the same as the OLS Matrix equation, the estimation process involves Matrix operations for partitioning variance and covariance, which are conceptually related to the OLS Matrix equation in handling linear relationships.

HalleBerryus's hands moved with purpose, accentuating her points and drawing Ynot further into the narrative that she was crafting.

Matrices also are used in nonparametric analyses, although the role they play is different from their use in parametric statistics like multiple linear regression. Although nonparametric methods do not assume a specific parametric form for the distribution of the data—which make them suitable for analyzing data that do not meet the assumptions required for parametric tests—matrices are used for organizing data, computing ranks, and facilitating certain calculations. This underscores the broad utility of the Matrix in statistical analysis, extending well beyond parametric models to include nonparametric and exploratory data analysis techniques. The next slide provides examples of how matrices are involved in nonparametric analyses:

Slide 11: Examples of How Matrices are Involved in Nonparametric Analyses

- In multivariate nonparametric methods, matrices can be used to organize data and calculate ranks across multiple dimensions. Techniques like multivariate analysis of variance (MANOVA) can be adapted to nonparametric forms where matrices hold rank-transformed data instead of raw scores.
- Nonparametric clustering algorithms, such as hierarchical clustering, often rely on distance matrices. These matrices contain the pairwise distances between observations and are crucial for determining how clusters are formed. The use of matrices here facilitates the efficient computation and manipulation of distances.
- For Kendall's Tau and the Spearman's rank correlation coefficient, matrices are useful in organizing data and calculating these coefficients for multiple variables simultaneously, especially when dealing with large datasets.
- Nonparametric bootstrap and permutation tests, which involve resampling data to estimate the sampling distribution of a statistic, can involve the use of matrices to store resampled datasets and to compute statistics across thousands or even millions of resampling iterations. This approach allows for efficient computation and analysis of the results.
- In nonparametric regression and classification, matrices are used for kernel methods to represent kernel functions that measure similarity between observations. These matrices, often called "kernel matrices" or "Gram matrices," are central to techniques like Kernel Density Estimation (KDE) and Support Vector Machines (SVMs).
- Nonparametric methods in network analysis involve use of matrices to represent graphs or networks, wherein elements of the matrix indicate the presence or strength of connections among nodes. Techniques for analyzing the properties of networks, identifying communities, or measuring centrality often rely on matrix operations.

After making this statement, there was a moment of silence as HalleBerryus gathered her thoughts, her chest rising with a deep, deliberate breath. The anticipation in Ynot's bedroom built. HalleBerryus then clicked to the next slide:

Slide 12: The Foundational Use of Matrices in Inferential Analyses

The use of matrices in inferential analyses is foundational and crucial for several reasons:

- This matrix framework facilitates the computation of estimates and predictions.
- Operations such as matrix multiplication, transposition, and inversion are fundamental in calculating parameter estimates, variances, and other statistics.
- Statistical software leverages matrix operations for efficient computation, allowing for the simultaneous processing of multiple equations or variables. This is particularly advantageous for complex models or large datasets.
- For general linear models (GLMs) that require iterative estimation procedures, such as structural equation modelling (SEM), software programs use matrices in optimization algorithms to find parameter estimates that minimize a cost function, often involving derivatives represented in matrix form.

HalleBerryus then extended her hands, her movements deliberate and meaningful, punctuating her words with a passion that underscored their significance. With a solemn determination, she declared:

So, there is absolutely no doubt that the Matrix has been a force for good in quantitative research!!!

Nodding enthusiastically, with a spark of realization in his eyes, Ynot replied:

I cannot agree with you more about the power of the Matrix in quantitative research. HalleBerryus, thank you so much for reminding me of this.

He took a moment, reflecting on his journey from a student to a professor, his expression one of gratitude mixed with nostalgia.

I was aware of this power during my graduate studies; however, since then, because I no longer undertake inferential statistics by hand and I rely on statistical software to undertake all the computations, I had forgotten…

He trailed off for a moment, lost in thought, then regained his composure with a renewed sense of purpose:

I had forgotten that when conducting inferential analyses, statistical software programs involve the extensive use of matrices behind the scenes.

HalleBerryus, standing beside him, nodded in agreement, her face illuminated by the soft light of the bedroom. She appreciated Ynot's acknowledgment of the foundational role of the Matrix in the realm of quantitative research. With a supportive smile, she gently stated:

Exactly, Ynot. Understanding the essence of the Matrix enhances our appreciation of the complexity and the beauty of quantitative research in general and statistical analysis in particular. It is like rediscovering the magic of the Matrix.

Ynot, visibly excited, applauded HalleBerryus's compelling presentation on the power of the Matrix in quantitative research. As his applause died down, a thoughtful expression crossed his face, signaling a shift in mood. With a hint of concern, turning to HalleBerryus, he stated,

OK, so, it is relatively straightforward to sell the power of the Matrix to quantitative researchers.

HalleBerryus, still smiling in the success of her presentation, turned towards Ynot, sensing the change in his tone. Ynot continued questioningly:

However, what about qualitative researchers? Many, if not most, or even all of them, would state that the Matrix does not have an important role in qualitative research….

His bedroom grew quiet, HalleBerryus's attention captured by Ynot's challenge. He continued, his voice filled with a mix of curiosity and skepticism:

….because the goal of qualitative research is to capture the voice. For example, we interview individuals that we believe will help us answer our research question(s), then we transcribe these interview data, and analyze these data, and then interpret them for the purpose of meaning making.

HalleBerryus listened intently, nodding in understanding. She recognized the importance of his question, with Ynot waiting in anticipation for her response. However, before she could respond, Mixedmethodus jumped in, thoughtfully stating the following:

Ynot, that is a profound question! Indeed, qualitative research focuses on the depth and richness of human experience, often seen as distant from the numerical world of the Matrix.

Mixedmethodus paused, collecting his thoughts for a moment before continuing:

However, the Matrix also can play an important role in *qualitative* research, albeit differently. It can help organize and categorize data, facilitating pattern recognition and thematic analysis. The essence lies not in quantifying the voice but in structuring our understanding of it. So, although the application differs, the power of the Matrix extends beyond numbers. It is about framing our insights, whether they are derived from statistical calculations or the narratives we gather.

Mixedmethodus stood at the forefront of Ynot's bedroom, a beacon of calm scholarly authority. HalleBerryus, equally esteemed, was at his side. The tension of anticipation was palpable among Ynot, his eyes fixed on the duo, expecting another enlightening exchange on the role of the Matrix. Contemplatively, Mixedmethodus began,

And so, we must consider...

Suddenly, HalleBerryus, with a mischievous glint in her eye, seized the moment to add an element of surprise. She deftly tossed the remote control towards Mixedmethodus. The remote arced gracefully through the air. Mixedmethodus, without diverting his gaze from Ynot or missing a beat, extended a single finger. With the precision of a seasoned martial artist, he caught the remote effortlessly, a move that elicited a gasp and a smattering of applause from Ynot. Nonchalantly, as if such feats were everyday occurrences, Mixedmethodus pressed the remote to advance the presentation, while stating:

Thank you, HalleBerryus.

The slide changed, and with it, the energy in Ynot's bedroom shifted to focus on the newly displayed information. With renewed focus, diving into the heart of the matter, Mixedmethodus continued:

Here are some examples of ways in which the Matrix is used qualitative research—specifically when analyzing qualitative data:

The screen behind him lit up with vibrant examples. Mixedmethodus gestured towards the screen, his movements precise and deliberate, as he walked Ynot through each example, elucidating the nuanced ways in which the Matrix brought clarity and depth to qualitative data analysis.

Slide 13: Ways in Which the Matrix Brings Clarity and Depth to Qualitative Data Analysis

- **Framework Analysis**
  - This analysis is a specific type of thematic analysis that uses a matrix to organize data according to key themes, concepts, or variables. The framework often is predetermined and guides the placement of data within the matrix for detailed examination.
- **Qualitative Content Analysis**
  - Matrices can be used in qualitative content analysis to organize textual data by themes or categories, making it easier to interpret the presence and significance of certain concepts within the data.
- **Narrative Analysis**
  - Matrices help organize and analyze narratives by breaking down stories into components (e.g., plot, characters, and themes) and comparing these across different narratives.
- **Discourse Analysis**
  - Matrices facilitate the organization of discursive elements across texts or transcripts, aiding in the analysis of linguistic features and their social or psychological functions.
- **Componential Analysis**
  - This analysis involves use of matrices to discover the differences among the subcomponents of domains.
- **Qualitative Comparative Analysis**
  - Qualitative comparative analysis (QCA) often involves the use of matrices to compare cases based on configurations of attributes or conditions. This method is used to identify patterns that lead to certain outcomes across cases. Central to QCA is the construction of a truth table.
- **Qualitative Meta-Synthesis**
  - When synthesizing findings from multiple qualitative studies, matrices can help in organizing and comparing the results across studies to identify overarching themes or insights.

Activating the pointer light on the remote, Mixedmethodus directed a beam towards the penultimate bullet item of Slide 14. The light from the pointer illuminated the term "Qualitative Comparative Analysis" on the slide, drawing Ynot's eyes to it. With a tone of reverence, Mixedmethodus stated,

> Developed by Charles Ragin in 1987, qualitative comparative analysis stands as a monumental approach for systematically analyzing similarities and differences across cases. It provides one of the most compelling examples of the use of the Matrix in qualitative research.

Clicking the remote to advance the slides, Mixedmethodus explained,

> Let us delve deeper into how qualitative comparative analysis employs the Matrix to unearth patterns and insights from complex data.

Slide 14: How the Matrix is Employed in Qualitative Comparative Analysis

- Qualitative comparative analysis (QCA) often involves the use of matrices to compare cases based on configurations of attributes or conditions.
- This method is used to identify patterns that lead to certain outcomes across cases.
- Central to QCA is the construction of a *truth table*.
- A truth table is a methodological tool used systematically to analyze relationships between different conditions (independent variables) and an outcome (dependent variable) across cases.
- The truth table lists all possible combinations of conditions and their associated outcomes, based on the principle of Boolean algebra.
    - Each row in the truth table represents a unique combination of the presence ("1") or absence ("0") of conditions, along with the observed outcome for that combination.
- **Components of a Truth Table**:
    - **Conditions**: These are the independent variables or factors being studied to understand their impact on the outcome. In a truth table, conditions are represented in binary terms (1 for presence, 0 for absence).
    - **Outcome**: The dependent variable or result that is influenced by the conditions. The outcome is also coded in binary terms (1 for presence, 0 for absence).
    - **Cases**: Each case or unit of analysis corresponds to a row in the truth table, representing a unique combination of conditions and the observed outcome.
- A truth table can be considered a form of matrix, specifically a binary matrix, where:
    - **Rows** represent different cases or combinations of conditions.
    - **Columns** represent the conditions and the outcome.
    - **Entries** in the table are binary (1 or 0), indicating the presence or absence of each condition and the outcome for each case.
- This matrix-like structure of the truth table allows researchers to perform systematic comparative analysis, helping to identify patterns or configurations of conditions that consistently lead to the observed outcome.
- By analyzing the truth table, researchers can deduce necessary and/or sufficient conditions for the occurrence of the outcome, contributing to the development of theories that explain complex causal relationships in social science research.
- In QCA, the analysis of truth tables typically involves further steps, such as minimizing the combinations of conditions to identify the most parsimonious explanations for the outcome.
- This process, akin to reducing complexity in a matrix, underscores the analytical power of the truth table as a matrix-like tool in qualitative research.

As he read this slide, a look of realization washed over Ynot. His eyes widened, and a moment of profound clarity seemed to strike him. He clasped his head with both hands, a physical manifestation of his internal Eureka moment. With a mixture of excitement and self-reproach, he exclaimed:

I am so embarrassed that, moments ago, I questioned the role that matrices play in qualitative research. How could I be so forgetful?!!

His voice echoed slightly in his bedroom, a testament to the depth of his realization. He began to pace up and down his room, animated by the surge of insight.

I have authored/co-authored articles about componential analysis. Indeed, I have co-authored a trilogy of articles with the prolific Professor Nancy Leech—that is Leech and Onwuegbuzie (2007, 2008, 2011)—in which we used the word "Matrix" or "matrices" when discussing componential analysis.

Mixedmethodus interjected:

Yes, and your trilogy of articles with Professor Leech have been extremely well cited, with your 2007 article been cited in more than 3,000 works, your 2008 article in more than 1,000 works, and your 2011 article in more than 1,300 works—totaling more than 5,000 citations among them!

He paused, turning back to the screen, his hands gesturing emphatically as he spoke:

And with respect to qualitative comparative analysis, I co-authored an article with the renowned Rebecca Weinbaum—namely, Onwuegbuzie and Weinbaum (2017)—in which we conceptualized how to use qualitative comparative analysis to synthesize information extracted from a literature review.

Ynot leaned forward, his fingers tracing the lines of text on the screen as if to connect physically with the ideas presented there.

In this article, we even created and displayed a truth table based on 55 articles extracted from our literature review. We even used the word *Matrix*, as follows: "This coding led to a data matrix that contains 1s and 0s for each of the 55 articles. From the matrix, we could construct a truth table…" (p. 366).

Addressing Ynot with an air of revelation, Mixedmethodus interjected:

Surpassing even Qualitative Comparative Analysis in demonstrating the profound influence of the Matrix in qualitative research is the landmark text by Miles and Huberman (1994). Celebrating its 30th anniversary as of this New Year's morning, it stands as the most cited qualitative research textbook, amassing more than 155,000 citations. This remarkable feat equates to an average of more than 14 citations per day over the past three decades! The book's monumental impact on qualitative research methodologies spans across social sciences, education, health, and beyond. Within its pages, the authors elaborate on 37 matrix-based analysis techniques, encompassing 19 within-case and 18 cross-case analyses, designed for the systematic organization, analysis, and interpretation of diverse data sets—a selection of which is showcased in the following two slides.

Slide 15: Miles and Huberman's (1994) Within-Case Matrix-Based Displays

Table 1

*Miles and Huberman's (1994) Within-Case **Matrix**-Based Displays*

Type of Display	Description
Partially ordered:	
Checklist **Matrix**	Way of analyzing/displaying one major concept, variable, or domain that includes several unordered components
Time-ordered:	
Event listing	**Matrix** or flowchart that organizes a series of concrete events by chronological time periods and sorts them into multiple categories
Time-ordered **Matrix**	Maps when particular phenomena occurred
Role-ordered:	
Role-ordered **Matrix**	Maps the participant's "roles" by sorting data in rows and columns that have been collected from or about a set of data that reflect their views, beliefs, expectations, and/or behaviors
Role-by-time **Matrix**	Maps the participant's "roles," preserving chronological order
Conceptually Ordered:	
Conceptually clustered **Matrix**	Text table with rows and columns arranged to cluster items that are related theoretically, thematically, or empirically
Thematic conceptual **Matrix**	Reflects ordering of themes
Effects **Matrix**	Displays data yielding one or more outcomes in a differentiated manner, focusing on the outcome/dependent variable
Case dynamics **Matrix**	Displays a set of elements for change and traces the consequential processes and outcomes for the purpose of initial explanation

Slide 16: Miles and Huberman's (1994) Cross-Case Matrix-Based Displays

Table 2

*Miles and Huberman's (1994) Cross-Case **Matrix**-Based Displays*

Type of Display	Description
***Partially ordered*:**	
Partially ordered meta-**Matrices**	Display descriptive data for each of several cases simultaneously
***Case-ordered*:**	
Case-ordered descriptive meta-**Matrix**	Contains descriptive data from all cases but the cases are ordered by the main variable of interest
Two-variable case-ordered **Matrix**	Displays descriptive data from all cases but the cases are ordered by two main variables of interest that are represented by the rows and columns
Case-ordered effects **Matrix**	Sorts cases by degrees of the major cause of interest, and shows the diverse effects for each case
Case-ordered predictor-outcome **Matrix**	Arranges cases with respect to a main outcome variable, and provides data for each case on the main antecedent variables
Predictor-outcome consequences **Matrix**	Links a chain of predictors to some intermediate outcome, and then illustrates the consequence of that outcome
***Time-ordered*:**	
Time-ordered meta-**Matrix**	Table in which columns are organized sequentially by time period and the rows are not necessarily ordered
***Conceptually ordered*:**	
Content-analytic summary table	Which allows the researcher to focus on the content of a meta-**Matrix** without reference to the underlying case
Variable-by-variable **Matrix**	Table that displays two major variables in its rows and columns ordered by intensity with the cell entries representing the cases
Antecedents **Matrix**	Display that is ordered by the outcome variable, and displays all of the variables that appear to change the outcome variable

After presenting the two preceding slides, Mixedmethodus concluded:

...And so, you see, the Matrix serves as an invaluable tool in our quest to uncover the deeper meanings within our qualitative inquiries, enabling us systematically to organize and to interpret the rich narratives at our fingertips.

Continuing with enthusiasm, Mixedmethodus stated,

Let me also take this opportunity to highlight how significantly *you* have incorporated Miles and Huberman's (1994) matrix displays into your own research endeavors. The forthcoming slide showcases a table from page 14 of one of your research studies—namely, Onwuegbuzie et al. (2014)—in which you, alongside your fellow researchers, delved into the everyday lived experiences of eight women doctoral students at two state universities in the southwestern United States, all on their journey toward earning doctorates. This particular table exemplifies what Miles and Huberman describe as a *theme-clustered matrix*. They articulate that such a Matrix organizes data around emerging themes, concepts, or categories directly stemming from the data or

closely linked to the research questions. This organizational method enables researchers to discern patterns, to unveil relationships, and to spotlight variances within their data, by methodically categorizing them into a structured array that brings together themes of a similar or related nature. Further, in your Onwuegbuzie and Weinbaum (2016) article, you provided a framework for visually displaying information extracted for literature reviews via Miles and Huberman's (1994) matrices, provided using an actual body of published works that were analyzed using some of these matrices; and illustrated how to use QDA Miner, a mixed methods data analysis software program, to facilitate these matrices.

Mixedmethodus, with a knowing smile, clicked the remote to transition to the next slide. The screen flickered and revealed an old Matrix from one of Ynot's qualitative research studies.

Slide 17: Example of a Theme-Clustered Matrix

Table 3: Theme Clustered Matrix of Eight Doctoral Students

Metathemes (MT) Themes	Kimberly	Li	Liz	Marchaline	Nichole	Ramona	Sandra	Savannah
Adjustment (MT1)								
Time management	7	9	18	13	12	8	10	14
Interaction	6	4	5	11	9	2	6	14
Belief			1		4			4
Lifestyle		4	1			1		
Total	13	17	25	24	25	11	16	32
Encouragement (MT2)								
Intrinsic motivation		1	4	3	2	1	5	13
Extrinsic motivation	7	4	20	9	12	7	8	8
Total	7	5	24	12	14	8	13	21
Discouragement (MT3)								
Internal	2	9	2	1	4		2	11
External	3	5				4		24
Total	5	14	2	1	4	4	2	35

Softly, more to himself than to Mixedmethodus and HalleBerryus, Ynot whispered,

It's like a walk down memory lane...

Turning to the Mixedmethodus and HalleBerryus, who were now standing side-by-side, with a newfound realization, Ynot concluded,

This moment... it reminds me why I was chosen by both of you for this crucial mission—to demonstrate the world the unparalleled power of the Matrix in unifying quantitative and qualitative research approaches in mixed methods research.

He paused, letting the weight of his words sink in:

Without even realizing it, I've been a staunch advocate for the power of the Matrix, not just in quantitative research but in qualitative research as well.

HalleBerryus and Mixedmethodus, in perfect unison, nodded their agreement, their movements mirroring each other precisely. Simultaneously, they began to speak, their voices harmonizing as they delivered their message:

> The power of the Matrix extends far beyond the realms of quantitative and qualitative research. Indeed, its influence permeates various fields and disciplines, many of which we will explore in the following slide.

No sooner had they finished speaking than the next slide seamlessly transitioned into view, ready to unveil the expansive reach of the Matrix.

Slide 18: How the Matrix is Utilized Across Fields and Disciplines

- **Parametric statistical analyses**
- **Bayesian Analysis**
- **Social Network Analysis**
- **Social Media Analysis**
- **Text Mining**
- **Geographical Information Systems (GIS)**
- **Psychometrics / Item Response Theory**
- **Economics** (e.g., input-output analysis)
- **Linguistics** (e.g., Natural Language Processing)
- **Anthropology** (e.g., kinship networks, social cohesion)
- **Political Science** (e.g., voting and social choice theory)
- **Physics** (e.g., quantum mechanics)
- **Medicine** (e.g., MRI, CT scans)
- **Machine Learning**
- **Image and Signal Processing**
- **Optimization and Operations Research** (e.g., supply chain management and logistics)
- **Environmental Science** (e.g., environmental impact assessment)
- **Genomics and Bioinformatics** (e.g., DNA sequences, genetic markers)
- **3D Computer Graphics**
- **Finance** (e.g., portfolio optimization, risk management)
- **Transportation Planning** (e.g., transportation demand modeling, traffic flow analysis)
- **Climate Science** (e.g., climate modeling)
- **Marketing and Consumer Behavior** (e.g., market segmentation, consumer preference analysis)
- **Robotics** (e.g., robot kinematics and control, robot perception and sensor fusion)
- **Ecology** (e.g., population dynamics modeling)
- **Materials Science** (e.g., materials characterization and analysis)
- **Archaeology** (e.g., seriation and classification)
- **Neuroscience** (e.g., brain connectivity analysis)
- **Energy Systems** (e.g., energy modeling and analysis)
- **Agriculture** (e.g., crop yield analysis and agricultural planning)
- **Sports Analytics**
- **Remote Sensing** (e.g., satellite imagery)
- **Urban Planning** (e.g., urban transportation and land-use modeling)
- **Financial Risk Management**
- **Music Information Retrieval** (e.g., music audio)
- **Neuroscience** (e.g., brain imaging and analysis)
- **Biochemistry** (e.g., protein structure prediction and analysis)
- **Game Theory** (e.g., strategic interactions)
- **Epidemiology** (e.g., disease spread analysis)
- **Quality Control**
- **Software Recommender Systems**

Upon witnessing the profound influence of the Matrix across various fields and disciplines, touching nearly every aspect of life, Ynot was taken aback, exclaiming in astonishment:

Wow!! I had no idea!

In perfect harmony, HalleBerryus and Mixedmethodus responded:

In the dawn of the Fifth Industrial Revolution, the presence of the Matrix is more pervasive than ever. Take, for instance, the rise of artificial intelligence (AI) tools like Chat-GPT. Since its launch by OpenAI on Wednesday, 30th November 2022, ChatGPT has captivated millions worldwide. Over the past 397 days, it has seen widespread experimentation and use in diverse areas, ranging from educational support and coding assistance to content creation and entertainment.

They continued, emphasizing the underlying mechanics:

Interestingly, at the core of Chat-GPT's training lies the Matrix. It is the Matrix that powers the intricate mathematical operations and computations, enabling the neural network model to assimilate and to respond based on the vast patterns discerned from its training data.

With a tone of enthusiasm, HalleBerryus then stated:

So far, we have journeyed through the realms of quantitative and qualitative research, appreciating the unique power of the Matrix in each. Now, let us pivot to the realm where these methodologies are integrated—Mixed Methods Research.

Ynot shifted, intrigued by the transition. HalleBerryus clicked the remote, and the slide changed to a portrait of the esteemed Dr. Rebecca K. Weinbaum, Associate Dean at Lamar University, Texas. Smiling warmly, HalleBerryus continued:

To remind you of the power of the Matrix in mixed methods research, I am going to showcase part of a doctoral dissertation written by Dr. Rebecca K. Frels (now Dr. Rebecca K. Weinbaum)—whom both you and I mentioned earlier. We remember you telling her at the time that, her doctoral dissertation (R. K. Frels, 2010), which she completed in 2010, is one of the best and most creative dissertations that you had *ever* read and that you were so honored and proud to be her dissertation chair/supervisor, which allowed you to witness firsthand a masterpiece unfold….

Ynot interjected, a note of surprise in his voice,

Yes, Rebecca is the most creative scholar that I have ever met! I have learned so much collaborating with her over the years, which culminated in our literature review book—Onwuegbuzie and Frels (2016)—that has more than 700 citations….but, wait a minute—How do you know that I said that to Rebecca?

Without missing a beat, HalleBerryus responded:

Mixedmethodus and I have been observing your journey, every step of the way, much like Morpheus and Trinity watched over Neo to confirm his role as "The One." In the same vein, we have been monitoring you, guided by prophecy and our belief, to ascertain whether *you* are "The Next One."

Ynot inhaled sharply in surprise, and simultaneously, the cinema audience mirrored his reaction with a collective gasp of their own….

With a calm and steady voice, HalleBerryus continued….

Although Dr. Frels framed her dissertation as a qualitative research study, throughout her dissertation, she adopted what the Eminent Professor Jennifer Greene (2007) referred to as a *mixed methods way of thinking* (cf. pp. 20-30). As Greene (2007) so powerfully described,

> "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).

In your radical middle article—Onwuegbuzie (2012)—you used the phrase "mixed methodological way of thinking."

HalleBerryus paused, drew a deep breath to gather her thoughts, seamlessly transitioned to the next slide with a click, and then, with a commanding presence, proclaimed,

Anyway, her dissertation, entitled, "The Experiences and Perceptions of Selected Mentors: The Diadic Relationship in School-Based Mentoring," delved into critical inquiries within the realm of educational mentorship. Her research primarily sought to unravel: (a) The varied experiences and insights of selected mentors engaged in school-based mentoring, focusing on their roles, objectives, and strategies within the mentoring dyad with elementary school students; and (b) The exploration of disparities and commonalities in the experiences and perceptions among school-based mentors who assist elementary school students, particularly examining how these aspects might differ based on the mentors' ethnic backgrounds.

Pausing for a moment to command Ynot's attention, HalleBerryus continued:

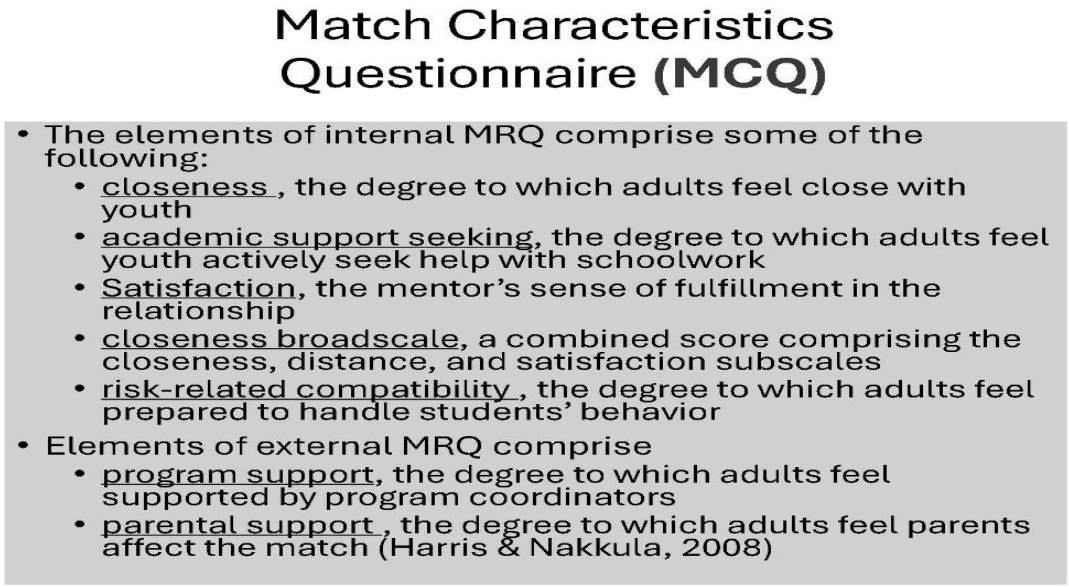
Her dissertation employed a research design described by Stake (2005) as a multiple-case study, incorporating a parallel sampling design as characterized by Onwuegbuzie and Leech (2007). This approach enabled robust and credible comparisons across multiple cases. Dr. Frels conducted interviews with 11 elementary school mentors—comprising 7 women and 4 men—within the confines of the school premises. These interviews varied in length, ranging from 30 minutes to an hour. She meticulously tape-recorded each session and implemented member-checking procedures to verify the accuracy and adequacy of both the interviews and her field notes, ensuring the trustworthiness of her findings.

With a voice that filled the space with its resonance and clarity, HalleBerryus further explained:

As part of the qualitative interview process, each mentor was asked to complete the Match Characteristics Questionnaire (MCQ; Harris & Nakkula, 2008), measuring match relationship quality. The MCQ, which contains 62 items across 15 subscales, was designed for mentors of primary and secondary school students. Harris and Nakkula (2008) reported that the overall internal MRQ yielded scores with a reliability of .95.

HalleBerryus's next slide presented some of the subscales of the MCQ:

Slide 19: Sample Subscales of the Match Characteristics Questionnaire (MCQ)



Gazing deeply into Ynot's eyes with a focused intensity, HalleBerryus continued, her voice steady and imbued with purpose:

Ynot, it might have slipped your mind, but you once collaborated with Dr. Frels on a popularized article that has received hundreds of citations—R. K. Frels and Onwuegbuzie (2013)—wherein you championed a novel approach in qualitative research. In this article, you proposed the innovative idea of integrating the administration of one or more pertinent quantitative instruments into the qualitative interview process. This could occur at any point—before, during, or even after the interview. You made a compelling case that the incorporation of quantitative data, particularly from instruments bolstered by normative data, significantly enriches the analysis. It allows qualitative researchers more effectively to situate their interview findings within a broader context, providing a depth of understanding that was previously unattainable. This strategy exemplifies a profound shift towards a mixed methods/mixed methodological way of thinking, offering a powerful toolkit for qualitative researchers to enhance their interpretive capabilities. This visionary approach not only bridges the gap between quantitative and qualitative research traditions but also elevates the overall impact and relevance of their qualitative research findings.

With conviction and a touch of inspiration, HalleBerryus continued…..

As part of the qualitative interview process, Dr. Frels collected nonverbal communication data, alongside the verbal data, as advocated by you and the extremely talented and esteemed Professor Sandra Schamroth Abrams—namely, Onwuegbuzie and Abrams (2021, in press). This collection of nonverbal communication data illuminated the depths of human interaction, capturing the subtle yet significant cues that enriched Dr. Frels's understanding of the interview responses of her 11 research participants.

Ynot, now completely captivated, leaned in as HalleBerryus prepared to delve deeper into the revelation before them, ready to be led on a journey of Matrix transformation. HalleBerryus explained:

To summarize, Dr. Frels meticulously collected a comprehensive set of data from each participant, including verbal and nonverbal interview data, observational notes, and MCQ scores. Furthermore, her analysis of the verbal interview data, employing Glaser's (1965) constant comparison analysis and Gee's (2005) discourse analysis approaches, facilitated the identification of emergent themes. These themes, in turn, enriched the research findings by serving as pivotal additional data points—specifically, a fifth set of data points.

HalleBerryus took a purposeful breath, conveying the moment's significance. With conviction, she stated the following:

Dr. Frels conducted a detailed analysis by visually comparing five distinct data sets. In the realm of quantitative research, this process might be likened to correlating variables, but in qualitative research, it is more aptly described as identifying connections or patterns within the data. These analytical comparisons drew upon methodologies that the prolific Dr. Tim Guetterman of the University of Michigan and other authors—specifically, Guetterman, Creswell, et al. (2015); Guetterman, Fetters, et al. (2015); Fetters et al., 2013; Bustamante (2019); Fetters and Tajima (2022); Guetterman et al. (2021); Guetterman and Fetters (2022); James et al. (2022); Johnson et al. (2019); Ling & Pang, 2022; McCrudden et al. (2021); Reeping and Edwards (2020, 2021); Svoboda and Guetterman (2023); and Younas and Durante (2022)—refer to as a *joint display*. Alternatively, Dr. Frels's visual comparisons could be referred to as yielding the more advanced form of joint displays that the artistically gifted Wendy Dickinson and I (i.e., Onwuegbuzie & Dickinson, 2008) refer to as a *crossover display*. This display includes *qualitizing*, which involves transforming quantitative data into a qualitative form, such as obtaining narratives to explore the meaning of numerical data (Onwuegbuzie & Teddlie, 2003; Sandelowski et al., 2009; Tashakkori & Teddlie, 1998) and/or *quantitizing*, which involves converting qualitative data into numerical codes that can be analyzed statistically (Miles & Huberman, 1994; Onwuegbuzie & Leech, 2019, 2021; Onwuegbuzie & Teddlie, 2003; Sandelowski et al., 2009; Tashakkori & Teddlie, 1998).

Taking a moment to collect herself, HalleBerryus locked eyes with Ynot, communicating the significance of what was to come. She then confidently moved the presentation to the next slide, as follows:

Slide 20: A Crossover Display from Dr. Frels's Dissertation

Qualitative Theme	Qualitative Data: Interview	Qualitative Data: Observation	Quantitative Data	Qualitative Data: Nonverbal
Self-disclosure	**Quotation**	**Activity Observed**	**MCQ Subscale**	**Relevant Nonverbal Emotion**
Stories about past childhood	I think a lot (.) because— in fact it was funny when we got put together [laughter], because it was... she has a parent who is in the hospital and my mother, when I was in elementary school... had a form of polio and she was out of my life basically for two years and I went and lived with a neighbor. [Margie]	• Talk • School work	• Support-seeking behavior of mentee • Relating focus • Closeness	• Contentment • Relief • (Disgust)
Stories about present experiences	I think, actually, in, in our conversations, the fact that I've been to Africa and I've shown him pictures and uh, video and talked about it, and he's made the connections. This is a lot like you know when he goes back and visits family in Mexico and so I think that's even given to him and idea of the life of the people we go and visit with in Africa. Really you know, really looks a lot the same; he's he's found that commonality which I think has been helpful. [Wes]	• Games • School work	• Fun focus • Sharing focus	• Amusement • Excitement • Relief

HalleBerryus elucidated the intricacies of the display on this slide, detailing its structure and significance with precision. She stated:

> Svoboda and Guetterman (2023) would refer to Dr. Frels's display here as a *Side-by-side Joint Display*, which represents a display that is structured around constructs, domains, or other categorizations to underscore similarities and differences—with this layout including a column for quantitative data, a column for qualitative data, and ideally, a column dedicated to meta-inferences. As noted previously, Onwuegbuzie and Dickinson (2008) would call this a *crossover display* because Dr. Frels's display includes MCQ subscale scores that had been qualitized, as can be seen in the fourth column of this display.

HalleBerryus paused, drawing a deliberate breath, her gaze seeking Ynot's eyes to ensure that he grasped the gravity of what she was about to reveal:

> Actually, rather than referring to Dr. Frels's display as a joint display or a crossover display, it is more appropriately described as a Matrix!

HalleBerryus's insight sparked another moment of profound realization for Ynot—a second Eureka moment! He exclaimed:

> I have been looking at Rebecca's display for 14 years now and I have presented this display in numerous workshops on qualitative methods and mixed methods while providing examples of crossover displays. Yet, I have never conceived of this display as embodying a Matrix. Wow! You have opened my eyes!! You have truly broadened my perspective!

Ynot inhaled sharply in awe, and synchronously, the cinema audience drew a collective gasp:

HalleBerryus responded:

Ynot, trust me! You haven't seen anything yet!

Smoothly, she clicked to the next slide. This slide illuminated Ynot's bedroom, revealing a groundbreaking concept that promised to revolutionize the field of qualitative research.

Slide 21: Matrix of Ekman's (1999) Neurocultural Model of Facial Expression

Emotion	Amaya	Natalie	Angela	Angelina	Laura Harris	Margie	Savannah	Coach	John Henry	Chad	Wes
Amusement	√		√	√	√						
Anger											
Contempt											
Contentment	√	√	√			√			√		√
Disgust							√		√		
Embarrassment											
Excitement				√		√					
Fear											
Guilt											
Pride in achievement		√			√	√		√		√	
Relief							√				
Sadness/distress											
Satisfaction	√	√	√	√	√	√		√	√	√	√
Sensory pleasure						√			√		√
Shame											
Total	3	3	3	3	3	5	2	2	4	2	3

HalleBerryus declared:

I recommend that *all* qualitative researchers who conduct interviews and focus group discussions seriously consider constructing a similar Matrix of nonverbal communication data. This Matrix involves the use of Ekman's (1999) neurocultural model of facial expression. This innovative model posits 15 core emotions, each linked to distinct, innate facial expressions. These expressions are further refined by societal norms, known as display rules, which dictate how emotions should be expressed in different social settings and how these norms vary across and within cultures. In this Matrix, the first column enumerates these 15 distinct emotions as identified by Ekman, who contended that each emotion is uniquely recognizable. As such, in this Matrix, the rows represent the 15 emotions, whereas the columns represent Dr. Frels's 15 emotions—providing a very informative framework to capture the nuanced ways that emotions are conveyed nonverbally during interviews and focus group discussions. This approach not only enriches the data collection process but also enhances the depth of analysis in qualitative research.

HalleBerryus cleared her throat for a moment before seamlessly continuing her discussion…

In the upcoming slide, you will observe an example featuring Savannah, a mentor in Dr. Frels's study, whose facial expressions clearly convey feelings of disgust and relief. It is important to make a mental note of this observation regarding Savannah for further discussion.

Slide 22: Inter-Respondent Matrix of Facial Expressions Highlighting Savannah's Profile of Facial Expressions

Emotion	Amaya	Natalie	Angela	Angelina	Laura Harris	Margie	Savannah	Coach	John Henry	Chad	Wes
Amusement	√		√	√	√						
Anger											
Contempt											
Contentment	√	√	√			√			√		√
Disgust							√		√		
Embarrassment											
Excitement				√		√					
Fear											
Guilt											
Pride in achievement		√			√	√		√		√	
Relief							√				
Sadness/distress											
Satisfaction	√	√	√	√	√	√		√	√	√	√
Sensory pleasure						√			√		√
Shame											
Total	3	3	3	3	3	5	2	2	4	2	3

With enthusiasm in her voice, HalleBerryus explained:

Building on Ekman's (1999) Neurocultural Model of Facial Expression, this framework can be transformed into what you (i.e., Onwuegbuzie, 2003) described as an *Inter-Respondent Matrix*. This innovative adaptation creates a Matrix that cross-references participants with the facial expressions identified in Ekman's model, resulting in a detailed participant-by-facial expression matrix. Within this Inter-Respondent Matrix of Facial Expressions, the presence or absence of specific facial expressions by each participant is recorded using a binary coding system: a "1" denotes the observation of a particular facial expression, indicating that the participant displayed that emotion, whereas a "0" signifies the absence of that facial expression. Using this binary coding system would transform Dr. Frels's Matrix of Facial Expression to the following Inter-Respondent Matrix.

Effortlessly, HalleBerryus transitioned to the subsequent slide:

Slide 23: Inter-Respondent Matrix of Facial Expressions

Onwuegbuzie's (2003) Inter-Respondent Matrix

Emotion	Amaya	Natalie	Angela	Angelina	Laura Harris	Margie	Savannah	Coach	John Henry	Chad	Wes
Amusement	1	0	1	1	1	0	0	0	0	0	0
Anger	0	0	0	0	0	0	0	0	0	0	0
Contempt	0	0	0	0	0	0	0	0	0	0	0
Contentment	1	1	1	0	0	1	0	0	1	0	1
Disgust	0	0	0	0	0	0	1	0	1	0	0
Embarrassment	0	0	0	0	0	0	0	0	0	0	0
Excitement	0	0	0	1	0	1	0	0	0	0	0
Fear	0	0	0	0	0	0	0	0	0	0	0
Guilt	0	0	0	0	0	0	0	0	0	0	0
Pride in achievement	0	1	0	0	1	1	0	1	0	1	0
Relief	0	0	0	0	0	0	1	0	0	0	0
Sadness/distress	0	0	0	0	0	0	0	0	0	0	0
Satisfaction	1	1	1	1	1	1	0	1	1	1	1
Sensory pleasure	0	0	0	0	0	1	0	0	1	0	1
Shame	0	0	0	0	0	0	0	0	0	0	0
Total	3	3	3	3	3	5	2	2	4	2	3

Ynot exclaimed:

Yes, of course!

HalleBerryus's eyes sparkled with the passion of someone who knew she was about to convince Ynot about the power of the Matrix in qualitatively driven mixed methods research. She declared:

Ynot, in your 2022 publication, Onwuegbuzie (2022), and even more assertively in your forthcoming article, Onwuegbuzie (2024), you have articulated how an Inter-Respondent Matrix can facilitate the four primary approaches to what you refer to as *first-level quantitizing*: **d**escriptive-based quantitizing, **i**nferential-based quantitizing, **m**easurement-based quantitizing, and **e**xploratory-based quantitizing. Using the first letter of each of these first-level quantitizing approaches led you to refer to this as DIME-driven quantitizing (Onwuegbuzie, 2024). In the advanced draft of your 2024 article, which is anticipated for publication later this year—a development closely monitored by both Mixedmethodus and myself—you detail the processes involved in each quantitizing approach.

HalleBerryus took a deep breath and continued….

Descriptive-based quantitizing utilizes statistical analyses to summarize data characteristics, encompassing measures of central tendency, variation/dispersion, position/relative standing, and distributional shape. Inferential-based quantitizing leverages quantitative analyses, possibly through general linear model (GLM) analyses, to estimate or to predict outcomes based on the qualitative data. Measurement-based quantitizing employs quantitative research methods like confirmatory factor analysis, Rasch analysis, or item response theory for developing instruments or score-validating constructs. Lastly, exploratory-based quantitizing applies quantitative analyses, such as exploratory factor analysis, principal components analysis, cluster analysis, or correspondence analysis, to categorize group membership, whether of participants or variables, aiming to uncover underlying patterns. These approaches collectively enhance the precision and applicability of qualitative research findings.

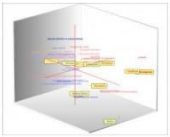
HalleBerryus locked eyes with Ynot, offering a warm smile, before proceeding with her detailed explanation:

Now, Dr. Frels's Inter-Respondent Matrix of Facial Expressions can be subjected to a statistical technique known as a *correspondence analysis*, a process into which we will delve in the following slide:

Slide 24: Explanation of Correspondence Analysis

Correspondence Analysis

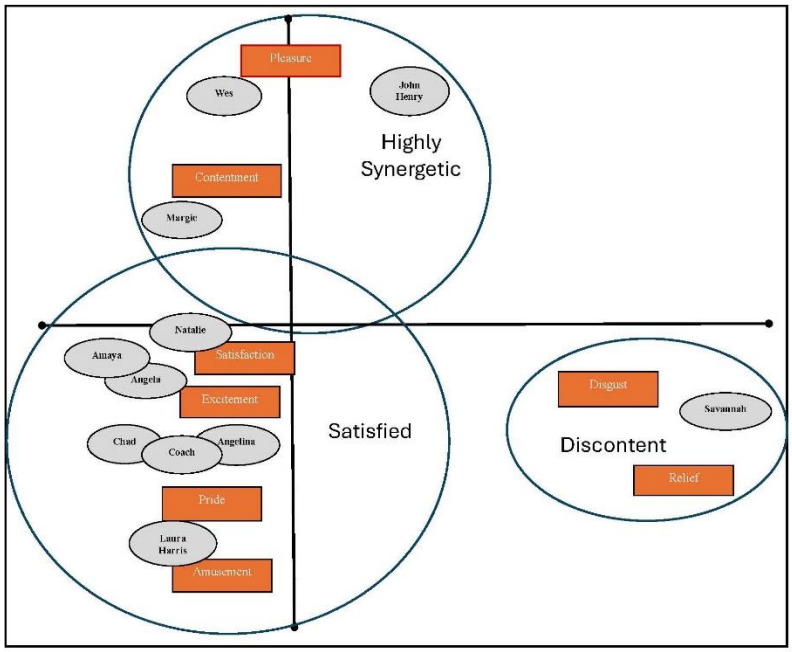
- Converts data organized in a two-way Matrix into graphical displays, with the categories of the two variables serving as points;
  - A correspondence plot, also known as a biplot, is the graphical representation resulting from correspondence analysis.
  - It displays the rows and columns of the contingency table as points in a two-dimensional space or three-dimensional space.
  - The proximity between points on the plot reflects their level of association in the dataset.
    - For instance, categories that are displayed close to each other are considered to have a similar profile across the variables analyzed.
- QDA Miner Version 2024 software program (Provalis Research, 2024) can be used to conduct a correspondence analysis.



11

HalleBerryus paused deliberately, ensuring her gaze intertwined with Ynot's, signaling the importance of the moment. With a skilled movement, she shifted to the next visual in her presentation:

Slide 25: Correspondence Plot Derived from the Inter-Respondent Matrix of Facial Expressions



HalleBerryus proceeded to explain this slide as follows:

> Ynot, as you are aware, correspondence plots are invaluable tools for analysts, enabling them to uncover three critical types of relationships: (a) interactions among themes, variables, or entities; (b) connections among research participants; and (c) the dynamic interplay between research participants and the various themes, variables, or entities. As stated in Slide 24, QDA Miner, which was developed by the renowned Dr. Normand Péladeau, conducts correspondence analyses. Dr. Normand Péladeau is a psychologist and President and Chief Executive Officer (CEO) of Provalis Research, the company behind *QDA Miner*, alongside other software such as *WordStat*, a content analysis and text mining software, *Simstat*, a statistical analysis and graphical software, *ProSuite*, a collection of Provalis Research's integrated text analytics tools, and *MVSP*, a powerful multivariate analysis program. Indeed, Dr. Péladeau is by far the most talented software developer in the world, uniquely credited with single-handedly creating comprehensive software suites for qualitative, quantitative, and mixed methods research. In fact, we would LOVE to have him on our Matrix team. His expertise would be a remarkable addition to our team. Given your close relationship with him, we hope you will help us recruit him for our Matrix team.

HalleBerryus took a momentary pause, giving Ynot a chance to ponder the contributions and camaraderie of his esteemed colleague, Dr. Péladeau, before she proceeded with her narrative...

> Specifically, Dr. Frels's correspondence plot in Slide 25 deftly categorizes her 11 mentors into three distinct groups, based on the facial expressions that they displayed during their interviews.

Directing the laser pointer towards the upper left quadrant of Slide 25, HalleBerryus elaborated:

> Notably, in the upper left quadrant of the correspondence plot, Mr. John Henry (an African American man), Wes (a White man), and Margie (a White woman) are grouped together, associated with expressions of contentment and pleasure. For Dr. Frels, these expressions collectively signified the meta-theme of *Highly Synergistic*.

Shifting the laser pointer to the lower left quadrant of Slide 25, HalleBerryus continued her explanation:

> In a striking contrast, as can be seen from the lower left quadrant of the correspondence plot, Amaya (a Hispanic woman), Angelina (an African American woman), Natalie (a Hispanic woman), Chad (a White man), Coach (an African American man), and Laura Harris (an African American woman) form a cluster characterized by facial expressions of satisfaction, excitement, pride, and amusement. These expressions converge to form the meta-theme *Satisfied*, as identified by Dr. Frels.

Lastly, guiding her laser pointer to the bottom right quadrant, HalleBerryus elaborated:

> Finally, as can be seen from the lower right quadrant of the correspondence plot, Savannah (a White woman) singularly is positioned around expressions of disgust and relief—a finding that echoes the observations in Slide 22. This distinct grouping led Dr. Frels to identify the meta-theme of *Discontent*.

HalleBerryus cleared her throat, steadying herself to deliver the insightful conclusion about the power of correspondence analysis via the Matrix, and then she resumed...

> Without conducting this correspondence analysis of this Matrix of facial expressions, Dr. Frels likely would never have uncovered the profound insights into how the nonverbal cues of these 11 research participants distinctly positioned them within their roles and experiences as mentors.

After HalleBerryus had finished her presentation of this slide, she took a brief pause, then proceeded to share her concluding remarks on the significance of the Matrix in qualitative research:

> This nuanced classification not only highlights the diversity of emotional responses among the mentors but also illustrates the power of the Matrix in analyzing nonverbal communication data, from which a correspondence analysis yielded revelations of complex emotional landscapes within Dr. Frels's dissertation research data. Therefore, as can be seen, in the realm of qualitative research, the Matrix serves as a foundational tool for analyzing a broad spectrum of qualitative data.

Once more, Ynot inhaled sharply in admiration.

Simultaneously, the audience drew in a collective breath of astonishment:

Suddenly, Mixedmethodus interjected to make a proclamation:

Alright, HalleBerryus has compellingly showcased the strength of the Matrix in dissecting qualitative data derived from a series of interviews with a relatively modest cohort of research participants. It is well recognized in mixed methods research that the kind of exploration Dr. Frels conducted would be classified as a *qualitative-dominant mixed methods analysis*.

With a deliberate stride, Mixedmethodus walked back and forth, then confidently announced:

I will now proceed to illustrate the formidable capabilities of the Matrix when applied to *quantitative dominant mixed methods analyses*.

Ynot extended his arms briefly to promote blood flow, his interest piqued by Mixedmethodus's timely interjection. In a seamless motion, once again, HalleBerryus deftly flung the remote control toward Mixedmethodus. It sailed through the air in a smooth arc, a perfect parabola against the backdrop of the presentation screen. Mixedmethodus, maintaining unwavering eye contact with Ynot, casually outstretched one finger and, with the ease of a maestro conducting an orchestra, snatched the remote from midair. Exhibiting a nonchalance that suggested such displays of dexterity were nothing out of the ordinary for him, Mixedmethodus clicked the remote, advancing the slides with a flourish, and began to speak:

Ynot, I am not sure if you remember the study that you conducted a few years ago with your talented colleague and friend, Dr. Emmanuel Ojo, Wits University, as well as four outstanding colleagues from Stellenbosch University: Drs. Talitha Crowley, Samantha P. Adams, Annie Burger, and Bryan J. Bergsteedt—who were all at Stellenbosch University at the time your study took place. Your study was entitled, "Challenges experienced by students at Stellenbosch University that hinder their ability successfully to learn online during the COVID-19 era: A demographic and spatial analysis" (Onwuegbuzie et al., 2020). Here is the article….

Slide 26: First Page of Published Article Entitled "Challenges experienced by students at Stellenbosch University that hinder their ability successfully to learn online during the COVID-19 era: A demographic and spatial analysis"

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Dialectical Publishing

Challenges Experienced by Students at Stellenbosch University that Hinder their Ability Successfully to Learn Online during the COVID-19 era: A Demographic and Spatial Analysis

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ABSTRACT
The purpose of this meta-methods study (i.e., involving the full[er] integration of multiple methods research approaches and mixed methods research approaches) was to examine challenges experienced by students at Stellenbosch University that hinder their ability successfully to learn online during the emergency remote teaching that began in April 2020 due to the COVID-19 pandemic. Specifically, 1,932 students completed an online questionnaire. Analyses of the open-ended responses via WordStat 8.0.29 topic modeling (i.e., crossover mixed analysis) led to the identification of seven (challenge) themes that categorised the students' challenges. In turn, via a principal component analysis of the themes (i.e., crossover mixed analysis), these seven themes were collapsed into four dimensions (i.e., meta-themes). A latent class analysis (i.e., qualitizing) yielded seven profiles of students. Disaggregating the themes by demographic and location variables led to the identification of subgroups who are most at risk for experiencing each challenge type. Implications of these and other findings are discussed.

KEYWORDS
Stellenbosch University; COVID-19; meta-methods research; quantitizing; qualitizing; topic modelling; mental health; student online learning readiness; demographic analysis; spatial analysis

Stellenbosch University Context

On 11th March 2020, the World Health Organisation declared the COVID-19 crisis to be a global pandemic. However, a month prior to this announcement, Stellenbosch University (SU) constituted a Contingency Committee to deal with the local spread of COVID-19 in South Africa, and the response to deal with the rapid nature around which circumstances could change. It was 2 days later, on the 13th March, when SU took deliberate steps to mitigate infection amongst its staff and student communities. Firstly, there was an immediate cancellation of the March/April 2020 graduation ceremonies, as well as the postponement of the installation ceremony that would welcome SU's newly appointed Chancellor, Justice Edwin Cameron. Moreover, all conferences scheduled to take place on the SU campus were cancelled until further notice. However, the academic programmes were all required to continue as normal, while a contingency plan was being formulated by all faculty deans and managers should the need arise. Travel bans were announced for international travel, while staff and students who were already abroad would need to quarantine for 14 days upon arrival in South Africa. The very first communiqué concluded with detail about the new dedicated webpage that was created for the dissemination of all coronavirus-related news (Retief, 2020a, 2020b).

The first presidential address took place on the 15th March—which would become informally known as a *family meeting*—where President Cyril Ramaphosa addressed the concerns related to the spread of coronavirus in South Africa. At this point in time, there was an estimated "162 000 people who had tested positive for the coronavirus across the globe" (Ramaphosa, 2020a, para. 4). Locally, a total of 61 cases were confirmed across

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Ynot replied,

> Yes, I remember it. We conducted it during the heights of COVID-19. Those were scary times for everyone

Mixedmethodus continued…..

> Your team's research question was "What challenges have been experienced by students at Stellenbosch University that hinder their ability successfully to learn online during the COVID-19 pandemic?" Using the framework of Plano Clark and Badiee (2010), this question represented what they referred to as a *general overarching mixed methods research question*. Such questions are characterized by their broad nature and are addressed through the integration of both quantitative and qualitative methodologies. Your team collected both qualitative data, via open-ended items, and quantitative data, via closed-ended items, such as Likert-format items, via an online questionnaire that was completed by 1,932 students at Stellenbosch University, South Africa. Here is a summary of the six sections of the inline questionnaire….

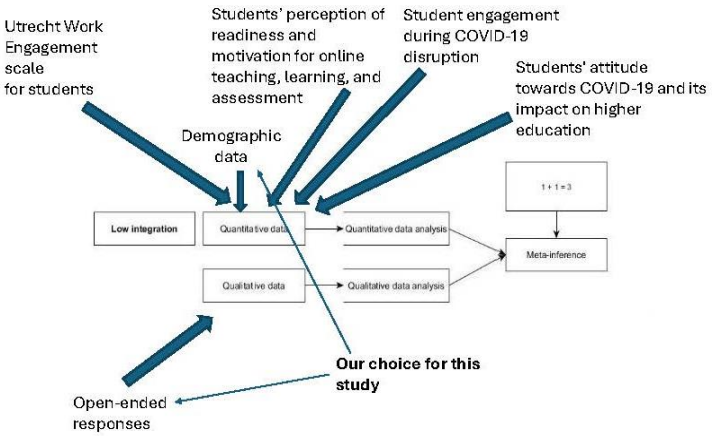
Mixedmethodus seamlessly transitioned to the subsequent two slides, enriching the presentation's flow:

Slide 27: Sections of the Online Questionnaire

Mixed Methods Research Approach

- A total of 1,932 students, who were enrolled at Stellenbosch University in 2020, completed an online survey: 6 sections
  - Section 1: Demographic items (e.g., gender, age, location)
  - Section 2: Students' perception of readiness and motivation for online teaching, learning, and assessment (i.e., Likert-type scale)
  - Section 3: Student engagement during COVID-19 disruption (i.e., Likert-type scale)
  - Section 4: Utrecht Work Engagement scale for students (i.e., Likert-type scale)
  - Section 5: Students' attitude towards COVID-19 and its impact on higher education (i.e., Likert-type scale)
  - Section 6: Included the following open-ended question: "What personal challenges do you have that could hinder your ability to successfully learn online?";

Slide 28: Selected Variables for the Study



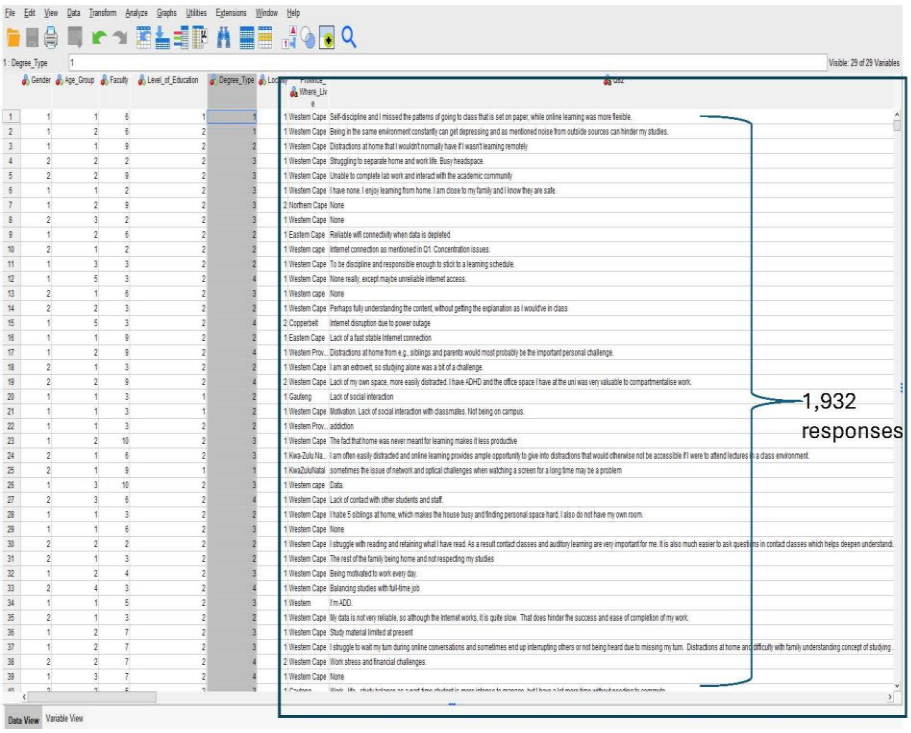
Mixedmethodus continued…..

As you can see from Slide 27 and Slide 28, your team selected to study one set of quantitative variables—namely, demographic variables, alongside the students' qualitative responses to the open-ended question, "What personal challenges do you have that could hinder your ability to successfully learn online?"

Mixedmethodus gracefully proceeded, weaving through the intricate fabric of the topic with eloquence and insightful depth:

As can be seen from Slide 28, your team nicely developed a Matrix from the demographic variables and the students' qualitative responses to the open-ended question.

Slide 29: The Matrix Containing the Demographic Variables and Open-Ended Responses Using SPSS



In a moment of reflective silence, Mixedmethodus stood before Ynot, his demeanor a blend of anticipation and gravity. He was about to unveil a new dimension in their research journey, a different kind of Matrix that promised to unlock deeper insights. Mixedmethodus took a moment, allowing the weight of anticipation to build, then with a practiced click, he advanced to the next slide, revealing the intricate process undertaken by Ynot's team:

> Your team embarked on an innovative quest, importing 1,932 sets of open-ended responses into the WordStat software program, a tool not just of analysis but of discovery. This was no mere data analysis; it was the first step into the realm of topic modeling, a realm where abstract topics emerge from the text as if by magic, but the magic, as you know, is in the Matrix.

Mixedmethodus continued, his voice carrying the gravity and excitement of the venture:

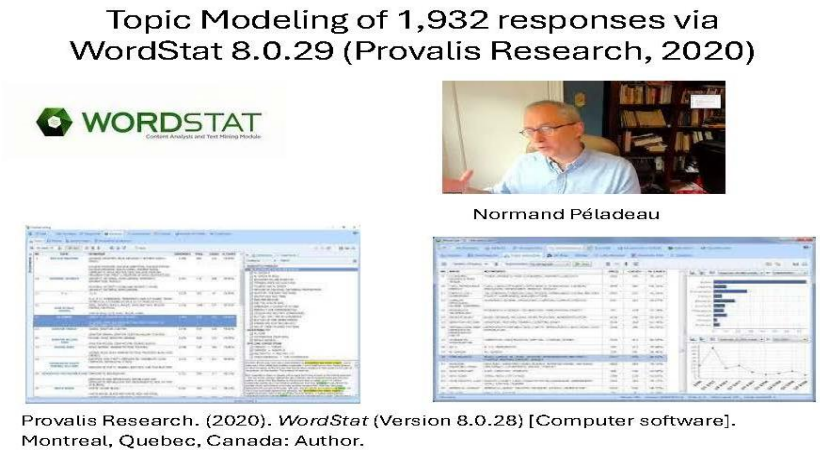
> As you know, topic modeling stands as a beacon in the vast sea of text, guiding us to clusters of text united not by tags or manual categorization but by the very essence of their content. This machine learning technique sifts through the unstructured wilderness to reveal patterns, patterns of words that cluster into *topics*—hence the term *topic modeling*—each a tapestry of words frequently found in communion within texts. The topics that emerge seamlessly serve as themes. It is a journey into the heart of texts, uncovering the thematic structures that lie hidden, waiting to be discovered.

With a playful hint of mystery, Mixedmethodus added:

> Observing your progress, HalleBerryus and I noticed your innovative approach. You didn't stop at just any analysis. Using WordStat developed by your friend Normand Péladeau—whom you have referred to many times as the most intelligent person you have ever met—you embarked on a topic modeling quest to extract the essence from those 1,932 responses. Your tool? Factor analysis through the Topic Extraction feature.

Mixedmethodus then showed the next slide:

Slide 30: WordStat Mixed Methods Software Program



Provalis Research. (2020). *WordStat* (Version 8.0.28) [Computer software]. Montreal, Quebec, Canada: Author.

Mixedmethodus continued, his narrative drawing Ynot into the depths of the topic modeling analysis:

> Your topic modeling analysis involved the construction of a Matrix—a *Word x Word Correlation Matrix*, also known as a *Word-by-Word Matrix*. Then, through factor analysis, you distilled the core themes, allowing words to belong to multiple factors. This reflects the complex reality of language, its polysemy, and the richness of context.

Mixedmethodus advanced the slide, showing an intricate sample Word-by-Word Matrix.

Slide 31: The Word-by-Word Matrix

Counts	mental	health	time	management	internet	connection	family	members
mental	0	**24**	3	4	1	2	5	1
heath	**24**	0	5	2	3	1	4	2
time	3	5	0	**15**	2	1	5	1
management	4	2	**15**	0	2	2	3	2
internet	1	3	2	2	0	**18**	1	1
connection	2	1	1	2	**18**	0	4	3
family	5	4	5	3	1	4	0	**12**
members	1	2	1	2	1	3	**12**	0

Mixedmethodus explained the sample Word-by-Word Matrix:

> This meticulously crafted sample Matrix unfolds before us as a vivid tableau of interconnected words, wherein the bolded figures stand out as beacons of significant co-occurrence. Take, for example, the words "mental" and "health," which are intertwined on 24 distinct occasions—marking the zenith of word association within this table. Such a striking level of co-occurrence is not merely a statistical coincidence; it weaves a narrative of convergence, suggesting that "Mental" and "Health" are intrinsically linked, merging into a cohesive topic of "Mental Health." This insight reveals how, within the tapestry of language, certain terms gravitate towards each

other, crafting thematic pillars that underpin the broader discourse, and highlighting the nuanced interplay of language that forms the cornerstone of topic modeling analysis.

With a playful hint of mystery, Mixedmethodus added:

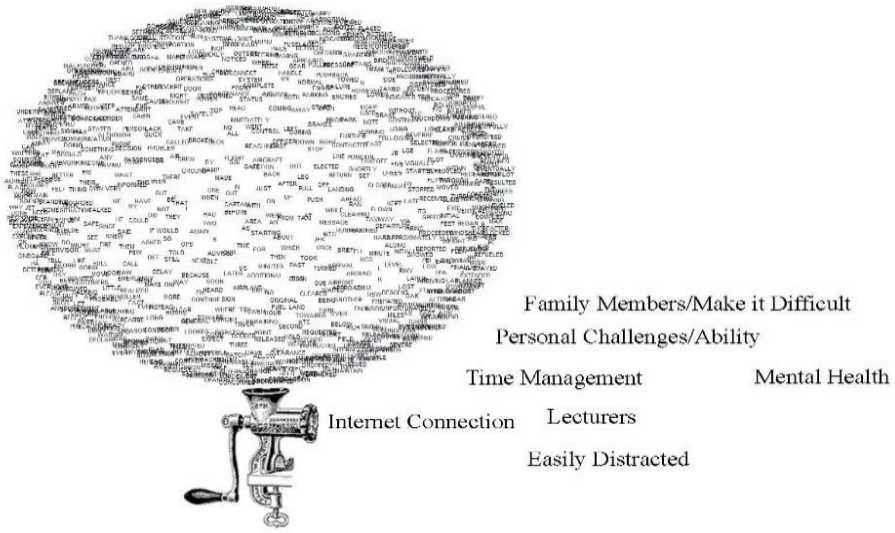
Observing your expedition into this uncharted territory, HalleBerryus and I were intrigued. Your choice of WordStat for conducting topic modeling was inspired, extracting the main themes from the plethora of open-ended responses with precision. Through factor analysis, a method as meticulous as it is revealing, you harnessed the Topic Extraction feature of WordStat to sift through the data, extracting the essence of the discourse.

Taking a deep breath, Mixedmethodus delved deeper into the methodology:

It is here, in this Word-by-Word matrix, that words find their alliance, grouped not by chance but by their intrinsic connection, revealing themes through a factor analysis that identifies the most resonant words within each topic. This is no simple cluster analysis where each word claims allegiance to a single cluster. Here, words may echo across multiple factors, which, as noted by Provalis Research (2014), is a testament to their polysemous nature and the rich tapestry of contexts in which they appear, a reflection of the complexity and richness of human language and thought.

Mixedmethodus's forthcoming slide unveiled a striking metaphor, depicting a meat grinder that meticulously transformed the words offered by the 1,932 research participants into coherent topics—essentially, distilling them into thematic essence that represented seven emergent topics.

Slide 32: Topics (i.e., Themes) Emerging from the Topic Modeling



The subsequent slide unfurled by Mixedmethodus was a captivating showcase, revealing the intricate layers of information elucidated by the innovative WordStat Topic Modeling feature. This visual portrayal not only highlighted the feature's analytical precision but also painted a vivid picture of how data can be transformed into meaningful insights, demonstrating the feature's prowess in navigating the complex terrain of textual analysis.

Slide 33: Relevant Information Related to the Emergent Topics (i.e., Themes)

Topics Extracted from the Responses Delineating the Challenges Experienced by Students at Stellenbosch University that Hinder their Ability to Successfully Learn Online During the COVID-19 Pandemic (n = 1,982)

No	Topic Labels	High Probability Terms	Coherence	Relative Proportion
1	Internet Connection	Internet; connection; slow; access; data; network; issues; connectivity; Internet connection; Internet access	.35	12.28
2	Mental Health	Health; mental; issues; mental health; mental health issues; stress; anxiety; depression; struggle; feeling	.32	6.41
3	Personal Challenges/Ability	Ability; hinder; online; learning; online learning; personal challenges; learn online; hinder my ability; ability to learn online; successfully learn online	.39	16.16
4	Time Management	Time; takes; difficult; long; hours; make; complete; time management; full time; part time	.33	26.11
5	Easily Distracted	Distracted; easily; focus; easily distracted; distracted easily; attention; disruption; distraction; noise; responsibility	.30	3.81
6	Family Members/Make it Difficult	Home; makes; difficult; study; room; space; working; environment; family members; makes it difficult	.32	20.40
7	Lecturers	Lecturers; contact; interaction; students; peers; lack; social; physical; online learning; face to face	.31	14.84

Mixedmethodus delved into the intricacies of the Topic Modeling table with a clear and engaging explanation:

> This Topic Modeling table, Slide 33, a key output of our topic modeling process, skillfully maps out the landscape of high-probability terms across seven distinct topics identified within you and his team's corpus of responses. Drawing on the methodologies recommended by leading topic modelists (cf. Provalis Research, 2014), the table meticulously catalogs the top 10 high-probability terms for each topic. These terms are not just words; they are beacons that uniquely define and distinguish each topic from the others.

Mixedmethodus then illuminated the topics that surfaced from the analysis, weaving a narrative that brought the data to life:

> We see before us a spectrum of human experience and concern, neatly segmented into seven compelling topics. Topic 1 delved into the *Internet Connection*, a fundamental aspect of emergency remote teaching and learning. Topic 2 opened a window into *Mental Health*, reflecting a by-product of students striving to negotiate their COVID-19 experiences. Topic 3, *Personal Challenges/Ability*, explored the individual struggles and strengths associated with the online learning process. *Time Management*, the fourth topic, addressed the universal challenge of balancing life's demands with learning remotely. Topic 5, *Easily Distracted*, revealed the common hurdles in maintaining focus while learning online during the COVID-19 era. Topic 6, *Family Members/Make it Difficult*, uncovered the complex dynamics of familial relationships during this COVID-19 period. Lastly, Topic 7, Lecturers, shed light on the pivotal role of educators during the students' online learning journey.

Mixedmethodus further explained the significance of topic coherence and text proportions in the Topic Modeling table:

> Beyond identifying these topics, this table in Slide 33 also provides insights into topic coherence—a measure of how semantically interpretable the terms are within each topic, offering a window into the clarity and relevance of the topics identified. Additionally, the relative proportion of text dedicated to each topic offers a glimpse into the prevalence and impact of each theme within the corpus.

Mixedmethodus's explanation transformed the Matrix from a mere collection of terms into a rich, thematic tapestry, offering profound insights into the collective psyche and concerns of the participants.

Locking eyes with Ynot in a moment of shared understanding, Mixedmethodus concluded:

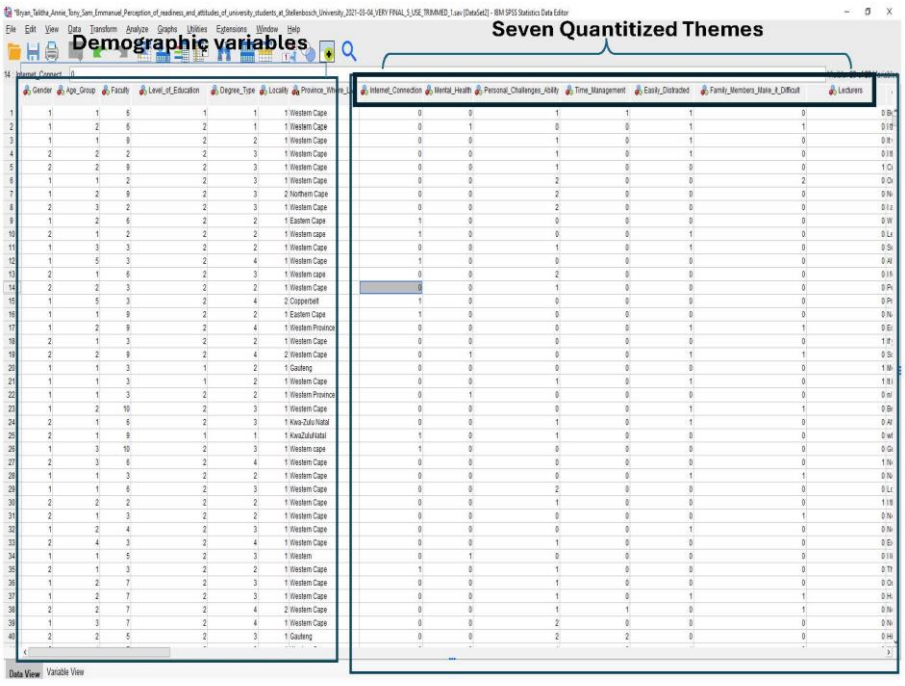
Thus, as we stand on the precipice of new knowledge, it becomes clear—the Matrix is not just a tool; it is the very foundation upon which the edifice of Topic Modeling is built, a vital key to unlocking the narratives woven into our data.

Ynot, electrified by a newfound clarity and enlightenment, burst into applause, a vibrant tribute to the profound journey upon which they had embarked. This outburst of appreciation was more than a mere gesture; it symbolized a deep acknowledgment of the intricate voyage through topic modeling, celebrating the rich insights unearthed from its profound depths.

Mixedmethodus's enthusiasm reached new heights as he readied himself to delve into the upcoming slide. His eyes sparkled with a fervent glint, betraying his eagerness. With a voice brimming with anticipation, he declared the following, setting the stage for an engaging exploration of the subject matter:

Now, once your team had meticulously delineated the seven themes through the innovative Word-by-Word Matrix feature of Topic Modeling, a transformative step ensued. These themes were intricately woven together within a Matrix alongside demographic variables, elevating the analysis to a new stratum of insight. This synthesis redefined the original SPSS-based Matrix presented in Slide 29, which initially cataloged demographic variables alongside open-ended responses, into an integrated Inter-Respondent Matrix. This evolution followed the innovative *quantitizing* methodology earlier introduced by HalleBerryus: whenever a research participant's response touched upon the hurdles of online learning, it was coded with a score of "1" under the relevant theme; otherwise, a score of "0" was given for that theme. Thus, each participant was evaluated on a binary scale for each theme, marking "0" for non-alignment and "1" for thematic resonance. This meticulous binary scoring process—namely, binarization—culminated in the creation of the following Inter-Respondent Matrix, a refined tool that not only mapped out the thematic landscape but also intersected it with the demographic fabric of the participant pool, offering a multidimensional view of the data at hand:

Slide 34: The Inter-Respondent Matrix



Earnestly, Mixedmethodus continued excitedly….

Without the creation of the Inter-Respondent Matrix, the analyst would have two sets of data: the demographic data, serving as quantitative variables, and the seven emergent themes serving as qualitative variables. Without the creation of the Inter-Respondent Matrix, these two datasets would force the analyst to conduct a quantitative

analysis and interpretation of the ensuing quantitative findings separately—whether the quantitative data represent the demographic data or the quantitative data from any of the four other sections of the team's online questionnaire for that matter—and then to conduct a qualitative analysis and interpretation of the ensuing qualitative findings, namely, the seven emergent themes. Therefore, even if both sets of interpretations are combined in a joint display during the meta-inference stage—wherein, as conceptualized by Tashakkori and Teddlie (1998), inferences stemming from both the qualitative and quantitative findings are combined into a coherent whole—the analyst would still be hypostatizing and reifying a quantitative–qualitative dichotomy. This quantitative–qualitative dichotomy resembles a state where combining insights feels akin to mixing oil and water. Despite analysts' efforts to merge these findings during the meta-inference stage, they are essentially attempting to bridge a divide that has been widened by their very approach to analysis. This is an example of the noteworthy 1 + 1 = 3 integration approach conceptualized and advocated by Fetters and Freshwater (2015).

Leaning in, Mixedmethodus explained….

Although this 1 + 1 = 3 approach would yield important insights about the students' challenges learning online during COVID-19, in this instance, it has limitations. That is, it faces its own challenge in fully integrating data. In particular, it would *not* allow the analyst to correlate the demographic data and the seven emergent themes. Now, the 1 + 1 = 3 integration approach has particular merit for situations wherein the quantitative research component and qualitative research component represent different research participants—what you and your prolific co-authors, Professor Kathleen M. T. Collins and Professor Qun G. Jiao, refer to as *parallel sampling* (Collins et al., 2006, 2007; Onwuegbuzie & Collins, 2007, 2014, 2017). However, in the context of your team's COVID-19 study, using the 1 + 1 = 3 integration approach actually would lead to *disintegration* at the data analysis stage. Specifically, the full integration in this study had occurred at the data collection stage, with each research participant contributing both quantitative and qualitative data at this stage; yet, during the data analysis stage, the quantitative data and qualitative data actually are separated before the monomethod analysis begins—that is, quantitative analysis of the quantitative data and qualitative analysis of the qualitative data. This separation of data does not represent *integration* but rather *disintegration*. At the data interpretation stage when conducting meta-inferences, including the use of joint displays, the quantitative and qualitative components are *reintegrated*. Unfortunately, the disintegration that occurs at the data analysis stage leads to this stage being conducted in a piecemeal manner, thereby resulting in important synergy being omitted from this stage. In summary, the full integration that occurs at the data collection stage, followed by the disintegration that occurs at the data analysis stage, and then followed by the reintegration that occurs at the data interpretation stage amounts not to full integration over the course of these stages but to *partial integration*. That is,

Full Integration + Disintegration + Reintegration = Partial Integration

With a twinkle of optimism, Mixedmethodus declared:

But there is a way to transcend this dichotomy. Enter your 1 + 1 =1 integration approach! By creating the Inter-Respondent Matrix in Slide 34, you and your team members were able to showcase the 1 + 1 =1 integration approach. You were not just combining datasets; you were redefining integration. Indeed, using your Onwuegbuzie (2004) typology, this Inter-Respondent Matrix allowed you to conduct first-level (i.e., DIME-driven) quantitizing—as described by HalleBerryus as comprising **d**escriptive-based quantitizing, **i**nferential-based quantitizing, **m**easurement-based quantitizing, and **e**xploratory-based quantitizing; second-level quantitizing, which comprises spatial-based quantitizing and time-based quantitizing; third-level quantitizing, which comprises cross-sectional-based quantitizing and longitudinal-based quantitizing; and fourth-level quantitizing, which comprises retrospective quantitizing and prospective quantitizing.

With excitement in his tone, Mixedmethodus continued….

Let me outline first-level quantitizing and second-level quantitizing. Let's begin with first-level quantitizing….

Motioning to the next slide, Mixedmethodus explained:

Within this first-level quantitizing, let's dive into the essence of this Matrix via descriptive-based quantitizing. Here, we quantify our qualitative insights, transforming thematic prevalence into numerical values that provide value-added information. Specifically, the prevalence rate of each of the seven themes was determined by summing the "1s" and "0s" and dividing by the sample size of 1,932.

Mixedmethodus then excitedly displayed the next slide:

Slide 35: Computing Prevalence Rates from an Inter-Respondent Matrix

Table 2

Example of How to Use the Inter-Respondent Matrix to Compute Effect Sizes for Four Participants

ID	Theme 1	Theme 2	Theme 3	Theme 4	Theme 5	Theme 6	Theme 7	Theme 8	Theme 9	Total	%
001	1	0	1	1	1	0	1	1	1	7	77.8
002	0	1	0	1	0	1	0	1	0	4	44.4
003	0	0	0	1	0	0	1	0	1	3	33.3
004	0	1	1	1	1	1	1	0	0	6	66.7
Total	1	2	2	4	2	2	3	2	2	20	
%	25.0	50.0	50.0	100.0	50.0	50.0	75.0	50.0	50.0		

Theme 1 = **R**esponsive
Theme 2 = **E**nthusiast
Theme 3 = **S**tudent-Centered
Theme 4 = **P**rofessional
Theme 5 = **E**xpert
Theme 6 = **C**onnector
Theme 7 = **T**ransmitter
Theme 8 = **E**thical
Theme 9 = **D**irector

Illustrating with his hands, Mixedmethodus explained….

In this example involving four participants, we see that Theme 4 is the most prevalent theme at 100%—meaning that all four participants endorsed this theme. In contrast, Theme 1 is the least prevalent theme at 25% because this was the only theme in which only one participant endorsed this theme. In other words, Theme 4 resonates across the board, a universal narrative among our participants, whereas Theme 1 whispers in the background, a rare but significant voice.

Motioning to the next slide, Mixedmethodus continued….

From Slide 36, it becomes clear that Personal Challenges/Ability emerged as the most resonant theme among our participants. A significant portion, nearly one third—that is .29 to be precise—of the students encountered hurdles learning online that fall under this banner. These challenges range from personal limitations to overcoming various obstacles, illuminating a profound narrative of resilience and struggle during COVID-19.

Slide 36: Descriptive-Based Quantitizing Conducted via Ynot's Inter-Respondent Matrix

Manifest Effect Size and Standard Deviation of Each Emergent Theme

Theme	Mean Frequency (i.e., Manifest Effect Size)	Standard Deviation
Internet Connection	.207	.41
Mental Health	.123	.33
Personal Challenges/Ability	.295	.46
Time Management	.145	.35
Easily Distracted	.208	.41
Family Members/Make it Difficult	.252	.43
Lecturers	.225	.42

Mixedmethodus allowed the gravity of the numbers to sink in before continuing, his tone reflecting the depth of the analysis:

> Closely following this, at 25%, is the theme Family Members/Make it Difficult. It is a poignant reminder of the complex dynamics that students had to navigate in their online learning environments, underscoring the influence of familial relationships on their remote learning experiences.

Ynot was captivated, hanging on every word as Mixedmethodus transitioned to a more sensitive topic. With a note of concern, Mixedmethodus continued…

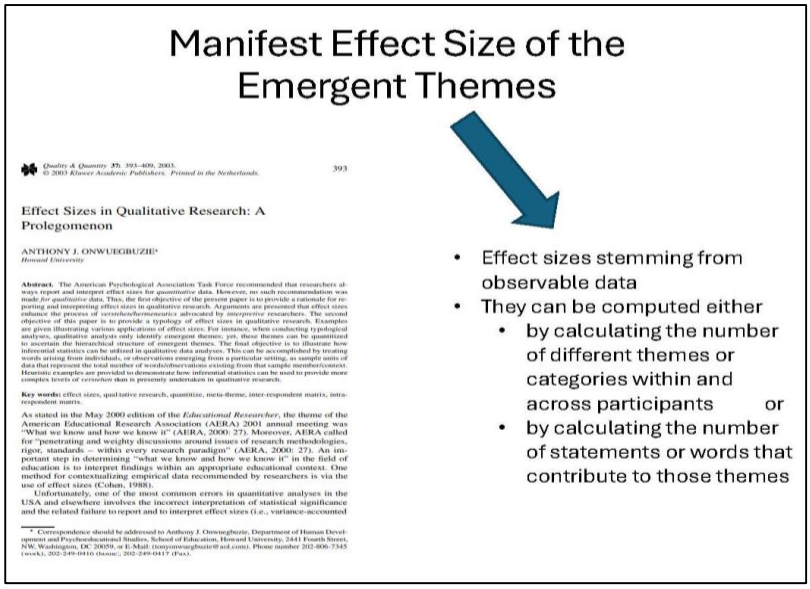
> However, it is the theme of Mental Health that commands our utmost attention, despite its lower prevalence rate of 12%. It is imperative to understand that behind this number are distressing revelations, including accounts of suicide ideation. This 12% isn't just a statistic; it represents a critical area of concern, highlighting the urgent need for support and intervention.

Mixedmethodus paused, allowing the significance of the findings to resonate with Ynot, his expression a blend of empathy and resolve.

> These prevalence rates served as what you have referred to as *manifest effect sizes* of the emergent themes, which represent effect sizes that pertain to observable content—specifically, an incident-based effect size (Onwuegbuzie, 2003).

Mixedmethodus then displayed the next slide:

Slide 37: Source and Definition of Ynot's Concept of Effect Sizes that Stem from an Inter-Respondent Matrix



Emphatically, Mixedmethodus declared:

> This analysis isn't merely about numbers; it is a window into the lived experiences of these Stellenbosch University students, a call to action for educators, policymakers, and researchers. We must look beyond the surface, understanding the depth and implications of these themes, as they hold the key to not just improving educational outcomes, but fundamentally enhancing the well-being of these students.

As the slide faded from the screen, a moment of reflective silence enveloped Ynot's bedroom, the impact of Mixedmethodus's words lingering in the air, a stark reminder of the power of the Matrix to illuminate and to advocate for change.

After a contemplative pause, Mixedmethodus resumed, his voice a blend of enthusiasm and scholarly rigor:

As we delve deeper into the realm of first-level quantitizing, let us shift our focus towards the innovative use of the Matrix for exploratory-based quantitizing. As the astute HalleBerryus has eloquently outlined, exploratory-based quantitizing involves applying quantitative analytical techniques—such as exploratory factor analysis, principal components analysis, cluster analysis, and correspondence analysis. This approach aims to categorize group memberships, be it participants or variables, to unearth latent patterns and connections. In your groundbreaking COVID-19 study, you used principal components analysis (PCA) to scrutinize the dimensionality of the seven emergent themes through the lens of the Inter-Respondent Matrix. Here, the PCA was meticulously applied to the intercorrelations among the theme pairs, elegantly transforming the Inter-Respondent Matrix into a Matrix of Zero-Order Correlation Coefficients. It is crucial to underscore that the PCA unfolded within the domain of the *correlation Matrix* rather than the *covariance Matrix*. This strategic choice guarantees that each theme receives equal consideration in our analysis, independent of their variance—a testament to the method's inclusivity and balance.

Mixedmethodus seamlessly continued, weaving deeper into the fabric of the methodology:

Before we proceed further, it is imperative to illuminate a pivotal preparatory step. The Matrix of *Zero-Order* Correlation Coefficients should undergo a transformative conversion to a Matrix of *Tetrachoric* Correlation Coefficients. This conversion is vital, especially given the binary nature (i.e., '0' vs. '1') of the quantitized themes. Tetrachoric correlation coefficients emerge as the method of choice for discerning the relationships between dichotomized variables. The use of tetrachoric correlation coefficients rests on the premise that each manifest binary variable masks a normally distributed latent continuous counterpart, characterized by zero mean and unit variance. Such an assumption gains credibility from your study's robust sample size of 1,932 participants, providing a solid foundation for the exploratory-based quantitizing.

Preparing to transition to the next segment, Mixedmethodus announced:

Fortuitously, our statistical toolkit is well-equipped with software programs like SAS, STATA, R, Mplus, and LISREL, each capable of facilitating the conversion from zero-order correlations to tetrachoric correlations. Although, it is worth noting that across these platforms, this intricate conversion process isn't simplified to a singular command. As we shall explore in the upcoming slides, the syntax required for executing this conversion in SAS (Slide 38), STATA (Slide 39), and R (Slide 40), highlights the nuanced differences and capabilities inherent to each software environment:

Slide 38: SAS Syntax for Converting a Matrix of Zero-Order Correlations to a Matrix of Tetrachoric Correlations

```
%macro TetrachoricCorrelations(data=, var1=, var2=);
   proc freq data=&data;
      tables &var1*&var2 / tetrachoric noprint out=Work.Tetra_&var1._&var2;
   run;

   data _null_;
      set Work.Tetra_&var1._&var2;
      if _N_ = 1 then call symput('corr_&var1._&var2', coestimate);
   run;

   %mend TetrachoricCorrelations;

data example;
   input Theme1-Theme7;
   datalines;
   0 1 0 1 0 1 0
   1 0 1 0 1 0 1
   0 0 1 1 0 0 1
   1 1 0 0 1 1 0
   ;
run;

%let themes = Theme1 Theme2 Theme3 Theme4 Theme5 Theme6 Theme7;

%macro ComputeAllPairs;
   %do i = 1 %to 7;
      %let var1 = %scan(%themes, &i, %str( ));
      %do j = &i+1 %to 7;
         %let var2 = %scan(%themes, &j, %str( ));
         %TetrachoricCorrelations(data=example, var1=&var1, var2=&var2);
         %put Tetrachoric correlation between &&var1 and &&var2:
&&&corr_&&var1._&&var2;
      %end;
   %end;
%mend ComputeAllPairs;

%ComputeAllPairs;
```

This example defines a macro to compute tetrachoric correlations between pairs of variables and another macro to automate this process across all unique pairs of the seven thematic variables. It utilizes PROC FREQ with the TETRACHORIC option for the actual computation. The tetrachoric correlation estimates are stored as macro variables and then printed to the log. This approach achieves the objective of computing and reporting tetrachoric correlations among multiple binary variables.

Slide 39: STATA Syntax for Converting a Matrix of Zero-Order Correlations to a Matrix of Tetrachoric Correlations

To compute the tetrachoric correlations between multiple binary variables in Stata and store the results in a comprehensive Matrix, you can use a combination of the `tetrachoric` command and Stata's Matrix commands. The approach involves using a loop to iterate through each pair of variables, calculate the tetrachoric correlation, and then store the result in a Matrix. Here's how you could do it:

```
* Define the list of variables
local vars Theme1 Theme2 Theme3 Theme4 Theme5 Theme6 Theme7

* Initialize an empty Matrix to store the tetrachoric correlations
matrix T = J(7, 7, .)

* Get the names of the variables into a local macro for later use
local varnames: var list Theme1-Theme7

* Loop over the variables using indexes to calculate and to store the correlations
forval i = 1/7 {
   forval j = i/7 {
      if `i' == `j' {
         matrix T[`i',`j'] = 1
      }
      else {
         local var1: word `i' of `vars'
         local var2: word `j' of `vars'
         quietly tetrachoric `var1' `var2'
         matrix T[`i',`j'] = r(rho)
         matrix T[`j',`i'] = r(rho)  * Copy to symmetric position
      }
   }
}

* Name the rows and columns of the Matrix to match the variable names
matrix rownames T = `varnames'
matrix colnames T = `varnames'

* Display the complete Matrix of tetrachoric correlations
Matrix list T
```

This script works as follows:

1. **Define the variables**: It first defines a list of your variables (Theme1 to Theme7).
2. **Initialize the Matrix**: It initializes an empty 7x7 Matrix `T` because you have seven themes. The `J(7, 7, .)` function creates a 7x7 Matrix filled with missing values (`.`).
3. **Loop through variables**: It uses nested loops to iterate over each pair of variables. For each pair, it calculates the tetrachoric correlation using the `tetrachoric` command and stores the result in the corresponding cell of the Matrix `T`. The diagonal elements are set to 1 since the correlation of a variable with itself is perfect.
4. **Symmetric Matrix**: Because the tetrachoric correlation Matrix is symmetric, the script explicitly copies each calculated correlation to the symmetric position in the Matrix to ensure that the Matrix is correctly filled.
5. **Name Matrix rows and columns**: It assigns row and column names to the Matrix `T` to match the variable names, making the Matrix easier to read and interpret.
6. **Display the Matrix**: Finally, it displays the complete Matrix of Tetrachoric Correlations using `Matrix list T`.

This approach gives you a full Matrix of Tetrachoric Correlations among your variables, neatly organized with row and column names corresponding to the variable names.

Slide 40: R Syntax for Converting a Matrix of Zero-Order Correlations to a Matrix of Tetrachoric Correlations

SPSS:

```
FACTOR
  /VARIABLES Theme1 Theme2 Theme3 Theme4 Theme5 Theme6 Theme7
  /MISSING LISTWISE
  /ANALYSIS Theme1 Theme2 Theme3 Theme4 Theme5 Theme6 Theme7
  /PRINT INITIAL KMO EXTRACTION ROTATION
  /FORMAT SORT
  /PLOT EIGEN
  /CRITERIA MINEIGEN(1) ITERATE(25)
  /EXTRACTION PC
  /CRITERIA ITERATE(25) DELTA(0)
  /ROTATION VARIMAX
  /METHOD=CORRELATION.
```

STATA:

```
* Ensure your data is correctly loaded and the variables Theme1-Theme7 are prepared.

* For listwise deletion of cases with missing data on specified variables.
drop if missing(Theme1, Theme2, Theme3, Theme4, Theme5, Theme6, Theme7)

* Perform Principal Component Analysis (PCA) specifying to keep factors with eigenvalues over 1.
pca Theme1 Theme2 Theme3 Theme4 Theme5 Theme6 Theme7, mineigen(1)

* Display the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy.
estat kmo

* Rotate the extracted factors using Varimax rotation.
rotate, varimax

* Stata does not have a direct /FORMAT SORT equivalent for sorting factor loadings in the output.
* Factor loadings can be reviewed manually in the output, or additional commands/scripts could be used for
sorting.

* Generate a scree plot to visualize eigenvalues.
graph scree

* Note: The PCA in Stata automatically uses the correlation matrix method when you apply the 'pca'
command, equivalent to /METHOD=CORRELATION in SPSS.
* Iteration control in Stata is managed automatically by the pca and rotate commands and might not need
explicit specification like in SPSS.

This Stata syntax covers the core of the SPSS factor analysis request:

- It addresses missing data through listwise deletion.
- It performs PCA on the specified variables.
- It restricts factor extraction to components with eigenvalues greater than 1.
- It applies a varimax rotation to the extracted factors.
- It calculates and displays the KMO statistic.
- It generates a scree plot to examine the eigenvalues.

Some aspects of the SPSS syntax, such as specific iteration controls and delta criteria for convergence, are
handled internally by Stata and do not have direct equivalents in the command syntax. Similarly, Stata's
output from `pca` and `rotate` commands may not exactly match SPSS's output format, especially regarding
sorted factor loadings, but essential information and statistical measures will be available for interpretation.
```

Mixedmethodus continued:

Once the Matrix of Tetrachoric Correlations had emerged, you would conduct the PCA on this Matrix. PCA is supported by virtually all major statistical software, each equipped to navigate through the complex landscape of data and to unveil underlying structures. The next slide shows the result of the PCA.

With anticipation building, Mixedmethodus gracefully transitioned to the next visual narrative, Slide 41, revealing the fruits of Ynot's analytical journey.

Slide 41: Pattern/Structure Coefficients from Principal Component Analysis (Varimax): Four-Factor Solution

Canonical Solution for First Function: Relationship Between the Five Demographic Variables and the Seven Emergent Themes

Variable	Standardized Coefficient	Structure Coefficient	Structure² (%)
Demographic:			
Gender	-.13	-.21	4.4
Age group	.71*	-.86*	74.0
Level of student	.18	.52*	27.0
Locality status	.39*	.55*	30.3
Registration status	.35*	.68*	46.2
Emergent Themes:			
Internet Connection	.45*	.60*	36.0
Mental Health	-.51*	-.55*	30.3
Personal Challenges/Ability	-.02	-.01	0.1
Time Management	.27	.33*	10.9
Easily Distracted	-.28	-.21	4.4
Family Members/Make it Difficult	-.20	-.15	2.3
Lecturers	-.52*	-.53*	28.1

*Practically significant coefficients with the effect sizes larger than .3 (Lambert & Durand, 1975).

Variables that are bolded have both a standardised coefficient and a structure coefficient that are practically significant; variables that are italicised but not bolded have either a standardised coefficient or a structure coefficient that is practically significant; and variables that are neither bolded not italicised (i.e., normal font) have a non-practically significant standardised coefficient and a non-practically significant structure coefficient.

On the illuminated screen, Slide 41 unfolded like a map to hidden treasures. Mixedmethodus, with a tone of revelation, guided the audience through this newfound terrain:

> The slide in Table 41 showcases how the seven distinct themes—each a story in its own right—maps onto four broader meta-themes, revealing the deeper currents beneath the surface of the data. The first meta-theme, a confluence of the 'Family Members/Make it Difficult' theme and the 'Easily Distracted' theme, coalesced into what you aptly named 'Home-Related Challenges.' This meta-theme captures the essence of domestic dynamics and distractions that impeded focus and productivity in terms of online learning.

He continued, his voice painting vivid imagery of the analysis's depth:

> The second meta-theme bridged the 'Internet Connection' theme with the 'Personal Challenges/Ability' theme, crafting the 'Connectivity and Personal Challenges' meta-theme. Here lies the intersection of digital access and individual capabilities, highlighting the critical role of connectivity in navigating personal hurdles during the emergency remote teaching and learning process.

With each word, Mixedmethodus drew Ynot deeper into the narrative:

> Emerging as the third meta-theme, the amalgamation of the 'Time Management' and 'Lecturers' themes gave rise to the 'Academic-Related Challenges' meta-theme. This dimension reflected the perpetual balancing act between managing time effectively and navigating academic expectations while learning online.

And, finally, with a gentle yet impactful conclusion:

> Standing alone yet resonant, the fourth meta-theme encapsulated the 'Mental Health' theme, a testament to its profound significance. This theme, now elevated to a 'Mental Health meta-theme,' underscored the pervasive impact of mental well-being within the context of the COVID-19 pandemic. This use of PCA represents exploratory-based quantitizing.

Through Mixedmethodus's eloquent narration, the PCA's revelations transformed from mere data points into a compelling narrative of challenges and experiences, each meta-theme a chapter in the larger story of the study's participants.

With excitement overflowing, Mixedmethodus prepared himself to present the core of the 1 + 1 = 1 integration approach. He stated:

As I previously illuminated, the creation and application of the Inter-Respondent Matrix transcend mere analytical steps; they embody the essence of a transformative tool in the realm of data analysis. In the absence of this matrix, an analyst stands at a crossroads, hindered by the inability to weave together the rich tapestry of quantitative data, such as demographic insights, with the vibrant hues of qualitative data emanating from participants' narratives about their online learning experiences during the COVID-19 era. These narratives crystallized into seven themes and, subsequently, into four meta-themes, each a beacon of understanding in the murky waters of this unprecedented period.

The absence of the Inter-Respondent Matrix would not just be a missed opportunity; it would be akin to navigating a complex labyrinth without a map, leaving the analyst bereft of the means to correlate, to dissect, and to delve deep into the essence of these themes and meta-themes. Such a scenario would starkly limit the analyst's capacity to disaggregate the data, an essential process for piercing the surface of raw information to reveal the intricate patterns and relationships within.

Yet, when armed with this Matrix, the once daunting task of disaggregation becomes not just feasible, but a gateway to a richer, more nuanced understanding. This tool does more than just enable analysis; it elevates the entire meaning-making process. It facilitates the emergence of meta-inferences that do more than connect dots; they provide a framework that places the thematic structure within a context that is immensely more informative and enlightening.

Through this lens, the Matrix is not merely a methodological asset; it is a catalyst for insight, transforming data into a narrative that speaks volumes, offering a panoramic view of the online learning challenges during a global crisis. It ensures that the voices of the participants are not just heard, but understood in their full complexity, enabling analysts to craft stories that resonate with truth, depth, and relevance.

Mixedmethodus paused, drawing in a deep, steadying breath, gathering not just air but resolve and clarity. In that moment of quietude, a sense of purpose swelled within, readying for the journey ahead. Then, with a newfound steadiness in his voice and a clear vision in his mind, he continued, weaving his narrative with renewed vigor and a deeper understanding of the path that lay before them:

The Inter-Respondent Matrix stands as a testament to the elegance and depth of analytical versatility, allowing analysts intricately to weave any single theme, multiple themes, or even the entire thematic spectrum with a variety of demographic variables. This capability becomes particularly striking given the substantial sample size of 1,932, a figure that not only underscores the robustness of the data but also significantly amplifies the potential for nuanced insights. Within this rich analytical landscape, the arsenal of general linear model analysis techniques—from correlation coefficients to independent samples *t* tests to analysis of variance (ANOVA) to multiple analysis of variance (MANOVA) to canonical correlation analysis to structural equation modeling (SEM) to hierarchical linear modeling (HLM)—unlocks unparalleled opportunities to explore and to understand the dynamic interplay between thematic elements and demographic variables, representing *inferential-based quantitizing*. This methodological bounty promises not only to enrich the analysis but also to offer a multidimensional perspective on the data, illuminating the pathways through which themes and demographics are intertwined.

Ynot offered a nod, his gesture steeped in silent agreement and admiration. He found himself in awe of Mixedmethodus's eloquent powers of persuasion, marveling at the seamless way that words were woven into compelling arguments. It was as if Mixedmethodus wielded language like a masterful artisan, crafting thoughts and ideas into a tapestry that captivated the mind and swayed the heart. In that moment, Ynot recognized the profound impact of such skill, feeling both humbled and inspired by the display of rhetorical finesse.

With a poised and reflective demeanor, Mixedmethodus resumed, his words flowing effortlessly like a serene river meandering through an ancient, whispering forest. Each sentence, carefully chosen and artfully delivered, resonated with Ynot, weaving a spell of understanding and insight. Mixedmethodus's continuation was not merely a progression of thoughts but a journey into the depths of discovery, inviting Ynot to explore the uncharted territories of intellect and imagination:

Ynot, in your illuminating Onwuegbuzie (2022) article, you didn't just provide an example; you unfurled a meticulously detailed roadmap—a veritable masterclass—on using the Inter-Respondent Matrix to undertake a canonical correlation analysis. This analysis—which involves *inferential-based quantitizing*—elegantly bridges the emergent themes with socio-demographic variables, unraveling the intricate tapestry of multivariate relationships between them. Canonical correlation analysis, a multivariate statistical technique, delves deep into the associations between two sets of variables, each comprising at least a pair of variables (Cliff & Krus, 1976; Darlington et al., 1973; Onwuegbuzie & Daniel, 2003; Thompson, 1984, 1991), offering a lens to view the multilayered interplay of data. This analysis approach can be used to analyze the current dataset of 1,932 participants. Specifically, the seven quantitized emergent themes can be correlated with two or more of the demographic variables. This analysis represents a testament to the power of rigorous analytical methodologies in unveiling hidden connections between themes and other quantitative variables, propelling us towards more nuanced, comprehensive understandings of thematic elements that emerge.

With a poised and deliberate motion, Mixedmethodus summoned the power of the remote control, orchestrating the transition to unveil the next slide in his visual narrative. As the screen flickered to life, it revealed a captivating tableau: an output from a canonical correlation analysis, a meticulous endeavor crafted by Ynot and his dedicated team. This analysis, both intricate and revealing, simultaneously mapped the intricate web of connections between the seven emergent themes and a quintet of demographic variables—each one a key to unlocking deeper insights. These variables: the students' gender, age, level of study, geographical nuances of their residency, and the pivotal aspect of their registration status (distinguished between the full-time and part-time academic journey), formed the coordinates for this exploratory voyage.

This slide, far more than being a mere visual aid, stood as a testament to the meticulous analysis undertaken by Ynot and his team. It was a beacon of scholarly rigor, illuminating the nuanced interplays that define and differentiate the student experience. Through this analytical prism, Mixedmethodus not only showcased the depth of their investigation but also painted a vivid picture of the diverse tapestry of student life, woven from threads of demographic diversity and thematic resonance. This moment, marked by the gentle click of a remote control, transformed Ynot's bedroom into a conclave of discovery, where each data point was a star in the vast cosmos of academic inquiry.

Slide 42: Output from the Canonical Coefficients for the First Function Characterizing the Multivariate Relationship Between the Five Demographic Variables and the Seven Emergent Theme

Canonical Solution for First Function: Relationship Between the Five Demographic Variables and the Seven Emergent Themes

Variable	Standardized Coefficient	Structure Coefficient	Structure^2 (%)
Demographic:			
Gender	-.13	-.21	4.4
Age group	.71*	-.86*	74.0
Level of student	.18	.52*	27.0
Locality status	.39*	.55*	30.3
Registration status	.35*	.68*	46.2
Emergent Themes:			
Internet Connection	.45*	.60*	36.0
Mental Health	-.51*	-.55*	30.3
Personal Challenges/Ability	-.02	-.01	0.1
Time Management	.27	.33*	10.9
Easily Distracted	-.28	-.21	4.4
Family Members/Make it Difficult	-.20	-.15	2.3
Lecturers	-.52*	-.53*	28.1

*Practically significant coefficients with the effect sizes larger than .3 (Lambert & Durand, 1975).

Variables that are bolded have both a standardised coefficient and a structure coefficient that are practically significant; variables that are italicised but not bolded have either a standardised coefficient or a structure coefficient that is practically significant; and variables that are neither bolded not italicised (i.e., normal font) have a non-practically significant standardised coefficient and a non-practically significant structure coefficient.

With a deliberate grace, Mixedmethodus wielded the laser pointer like a conductor's baton, guiding the beam with precision across the slide. Each targeted illumination brought into sharp relief the bolded variables, casting them as protagonists in this unfolding story of data. The focused light danced from one variable to the next, drawing a silent symphony of attention to the intricate details laid bare on the screen.

Pausing for a moment, Mixedmethodus then spoke with a tone of genuine appreciation and scholarly camaraderie:

Ynot, the eloquence and clarity with which you and your team have articulated the essence of this table are truly commendable. Allow me to echo your words.

Mixedmethodus began setting the stage to recite a passage that had captured his intellectual admiration. This gesture, simple yet profound, served as an acknowledgment of the rigorous analytical work undertaken by Ynot and his team. Mixedmethodus, in this act of quotation, transformed Ynot's bedroom into a shared space of discovery, where the power of analysis and the elegance of expression converged:

"Overall, the canonical correlation solution for the first canonical function indicated that the multivariate relationship was mostly characterized by the relationship between age group, locality status, and registration status on the demographic side and Internet Connection, Mental Health, and Lectures on the emergent themes set. More specifically, the youngest students, local students, and full-time students were more likely to experience challenges associated with Internet connectivity and less likely to experience challenges associated with mental health and online lectures" (Onwuegbuzie et al., 2020, p. 256).

With palpable enthusiasm, Mixedmethodus declared:

Even more impressively, drawing from your canonical correlation analysis findings, complemented by a series of detailed chi-square analyses and odds ratios—which also represented *inferential-based quantitizing*—you meticulously disaggregated the themes according to the socio-demographic factors of the student participants. This thorough and innovative approach led you and your team to develop an extremely informative crossover Matrix, illustrated as follows:

Mixedmethodus smoothly transitioned to the next slide, continuing the presentation:

Slide 43: A Partial View of a Crossover Matrix Displaying the Disaggregation of the Seven Emergent Themes According to the Socio-Demographic Factors of the Student Participants

Demographic Variables that are Statistically Significant Predictors of Each Theme

Theme	Finding
Internet Connection	**AGE GROUP:** Students older than 24 years of age are 1.61 times (95% confidence interval [CI] = 1.27, 2.05) more likely than are students in the 18-24 age group to indicate problems associated with Internet connectivity.
	LOCALITY: International students are 2.29 times (95% CI = 1.60, 3.28) more likely than are local students to indicate problems associated with Internet connectivity.
	REGISTRATION: Part-time students are 1.50 times (95% CI = 1.08, 2.09) more likely than are Full-time students to indicate problems associated with Internet connectivity.
Mental Health	**GENDER:** Female students are 1.83 times (95% CI = 1.35, 2.47) more likely than are male students to indicate problems associated with mental health.
	AGE GROUP: Students in the 18-24 age group are 1.73 times (95% CI = 1.73, 3.57) more likely than are students older than 24 years of age to indicate problems associated with mental health.
	LEVEL OF STUDENT: Undergraduate students are 2.02 times (95% CI = 1.51, 2.72) more likely than are postgraduate students to indicate problems associated with mental health.
	REGISTRATION: Full-time students are 3.98 times (95% CI = 1.90, 8.36) more likely than are Part-time students to indicate problems associated with mental health.
Personal Challenges/Ability	**No statistically significant predictors**
Time Management	**AGE GROUP:** Students older than 24 years of age are 1.47 times (95% CI = 1.12, 1.94) more likely than are students in the 18-24 age group to indicate problems associated with time management.
	LEVEL OF STUDENT: Postgraduate students are 1.38 times (95% CI = 1.06, 1.80) more likely than are undergraduate students to indicate problems associated with time management.

Mixedmethodus directed his laser pointer towards the second row on the slide, elaborating on the disaggregation conducted:

> In this methodologically rigorous example, the second row highlights how the theme of mental health is influenced by four socio-demographic factors: gender, age group, level of education, and registration status. Specifically, the women students had a 1.83 times higher likelihood (95% confidence interval [CI] = 1.35, 2.47) of reporting mental health issues than did the men students. Those in the 18-24 age group had a 1.73 times greater probability (95% CI = 1.73, 3.57) of indicating mental health concerns compared to students older than 24. Undergraduate students showed a 2.02 times higher chance (95% CI = 1.51, 2.72) of mental health problems than did postgraduates, and the full-time students were 3.98 times more likely (95% CI = 1.90, 8.36) to report such issues than were the part-time students. These four sets of findings indicate that the students at Stellenbosch University who reported experiencing problems associated with mental health, which hindered their ability successfully to learn online during the COVID-19 era, were most likely to be women, in the 18-24 age group, undergraduate students, and full-time students. These four factors represent the *narrative profile* of students who experienced mental health problems during the COVID-19 period. In turn, this narrative profile represents a form of *qualitizing* wherein the qualitative responses provided by the 1,932 students led to themes—that is, qualitative data—which then were quantitized by transforming these emergent themes to quantitative form within a Matrix—the Inter-Respondent Matrix. Then, these quantitized thematic data were correlated with quantitative data, namely, socio-demographic data, which led to the statistically significant and practically significant correlations being qualitized to yield a narrative profile for each emergent theme. Therefore, your groundbreaking table represents both quantitized and qualitized information that reflect the 1 + 1 = 1 process—thereby setting it apart from joint displays that reflect a 1 + 1 = 3 process.

Mixedmethodus smoothly transitioned, his keen focus shifting to illuminate the next slide, eager to unveil the depths of Ynot's analysis further:

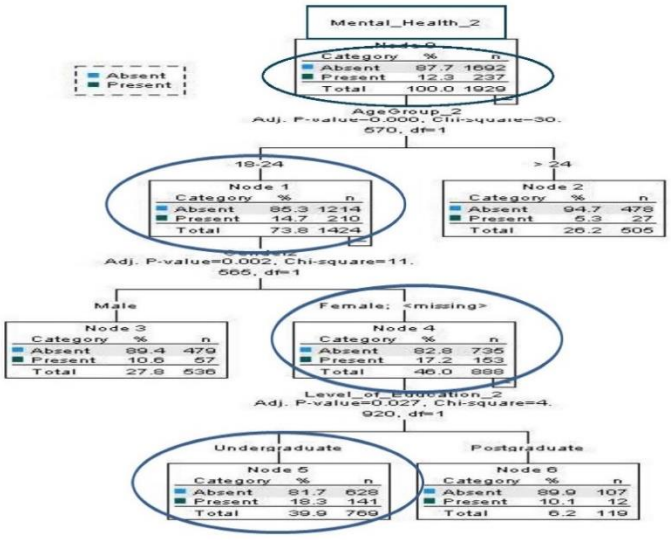
> Another innovative analysis that you and your team undertook via the use of the Inter-Respondent Matrix was the Chi-Square Automatic Interaction Detection analysis—which can be abbreviated to CHAID. Broadly speaking, CHAID analysis, introduced by Kass in 1980, is a sophisticated tree-based method designed for identifying key segments that contribute to a predictive model or tree. Utilizing advanced statistical algorithms, it segments data into groups that are statistically significant predictors of a dependent variable. The beauty of CHAID lies in its ability to organize these results into a clear, hierarchical structure. This hierarchy visually identifies the most potent predictor of a dependent variable, followed sequentially by the next most influential predictor, continuing in this manner until it encompasses all significant predictors. The outcome is a set of classification trees, a format that is both informative and accessible, as documented by Hand et al. (2001) and Magidson (1994). Collins (2021) further elucidates that CHAID is invaluable in mixed methods analysis, particularly after qualitative data have been quantitized. This makes CHAID a versatile tool in the arsenal of researchers, capable of unraveling complex data patterns within a mixed analysis framework.

Mixedmethodus continued:

> You treated each of the seven emergent themes as dependent variables and the five demographic variables, previously used in the canonical correlation analyses, as independent variables. Then, you used this CHAID analysis to ascertain which of these demographic variables stood out as statistically significant predictors. This is yet another example of *inferential-based quantitizing*. This rigorous examination was aimed at unraveling further the intricate relationships between demographic characteristics and the thematic outcomes. Here is some partial output from this analysis:

With a thoughtful pause to guarantee Ynot's attention, Mixedmethodus gracefully navigated his presentation forward, ushering in the next slide with an air of anticipation. His movement was deliberate, signaling a deep dive into the next chapter of Ynot's compelling analysis:

Slide 44: Demographic Predictors of the Internet Connection Theme Identified via Chi-Square Automatic Interaction Detection (CHAID) analyses



With a precise and practiced hand, Mixedmethodus directed his laser pointer towards Slide 44, casting a beam of light that seemed to carry the weight of anticipation. As Ynot's gaze followed the red dot to the heart of the new slide, he proceeded, his voice carrying the promise of intriguing insights yet to be unveiled:

Slide 44 reveals a nuanced breakdown of the challenges faced by students learning online during the COVID-19 pandemic. Notably, 20.7% of students identified Internet connectivity issues as a significant barrier to their online learning success, contrasting with the 79.3% who did not perceive it as a concern. The analysis pinpointed locality status as the foremost predictor of concerns about Internet connectivity, with international students (35.6%) disproportionately more likely to report such challenges compared to their local counterparts (19.5%). Age emerged as the second strongest predictor, illustrating a distinct trend: among the local cohort, students older than 24 years (23.2%) reported connectivity issues more frequently than did the younger 18-24 age group (18.3%). Similarly, among international students, those who were older than 24 years (45.2%) were significantly more likely to mention this theme than were students in the 18-24 age group (22.7%). Furthermore, level of education surfaced as another critical factor influencing this theme. Specifically, among the local students older than 24 years of age, undergraduates (32.4%) reported more significant challenges with Internet connectivity than did postgraduate students (21.3%), highlighting a complex interplay of demographic factors in the online learning experience.

Drawing in a deep, steadying breath, imbuing himself with a moment of calm resolve, Mixedmethodus prepared to delve deeper. With a renewed sense of purpose, he continued, ready to unfold the next layer of his intricate Matrix narrative:

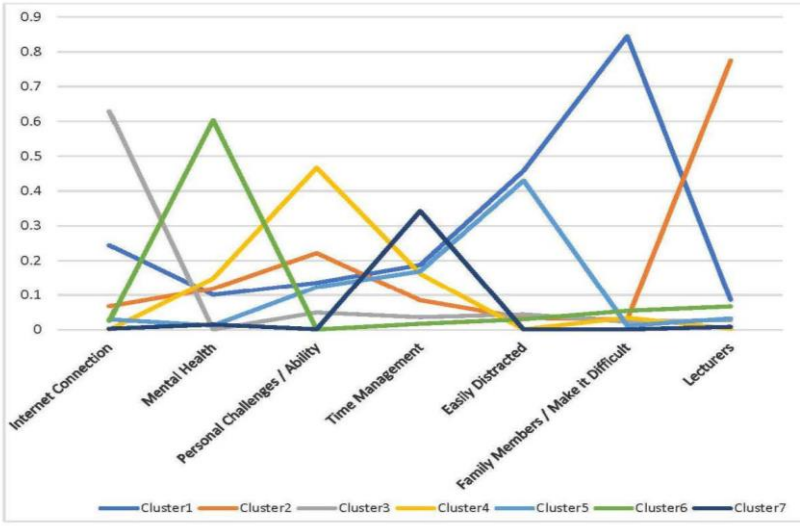
Yet another innovative analysis that you conducted via the Inter-Respondent Matrix was a latent class analysis. As you know, a latent class analysis (LCA) is a statistical method used to identify subgroups within a larger group based on their responses to observed variables. These subgroups, or "latent classes," are not directly observable but are inferred from the patterns in the data. LCA helps researchers discover underlying structures in data, revealing distinct categories or classes of participants who share similar characteristics or responses. This method assumes that the heterogeneity of the group's responses can be explained by the presence of these latent classes. By analyzing patterns of responses or characteristics, LCA assigns probabilities to each individual's membership in each class, thereby allowing researchers to classify individuals into groups with high accuracy based on their likelihood of belonging to these groups.

Mixedmethodus continued:

The latent class analysis on seven emergent themes—providing yet another example of *inferential-based quantitizing*—resulted in identifying seven distinct student clusters, each with unique characteristics based on the following profile. The clusters and their student proportions were: 25.74% for Cluster 1, 19.74% for Cluster 2, 14.84% for Cluster 3, 14.17% for Cluster 4, 10.61% for Cluster 5, 9.08% for Cluster 6, and 5.82% for Cluster 7.

With an expert and deliberate gesture, Mixedmethodus advanced his presentation to the next slide, Slide 45, and then guided his laser pointer towards this slide. The beam of light that it emitted seemed to weave through the air, laden with the palpable sense of expectation and intrigue, as if heralding the unveiling of critical insights:

Slide 45: Profiles of Students with respect to the Seven Emergent Themes



Mixedmethodus, understanding the weight of the information just presented, allowed a brief interlude of silence to settle over Ynot's bedroom, giving Ynot the time to absorb the complexities of the slide. Then, with a clear and engaging tone, he proceeded to unravel the intricacies of the data, ensuring comprehension in the wake of revelation:

As you can see from Slide 45,

- Cluster 1 includes students mostly distracted by family members, showing low levels in most themes but moderate in the Easily Distracted theme.
- Cluster 2, the Lecturers cluster, has students reporting almost exclusively (98%) under the Lecturers theme.
- Cluster 3, the Internet Connection cluster, is marked by nearly all (97%) students experiencing internet-related issues.
- Cluster 4 represents the Personal Challenges/Ability cluster, with 98% of students reporting significant personal challenges.
- Cluster 5, or the Easily Distracted cluster, includes students (95%) predominantly facing distraction issues.
- Cluster 6 is identified as the Mental Health cluster, with 92% of students indicating mental health concerns.
- Cluster 7, the Time Management cluster, consists of students (95%) primarily struggling with time management.

These clusters provide a nuanced understanding of the varied challenges that students faced, highlighting specific areas such as lecturers, Internet connectivity, personal challenges, distractions, mental health, and time management as key factors impacting their learning experiences during the COVID-19 era.

The moment had arrived for Mixedmethodus to introduce the next analysis that could be conducted based on the Inter-Respondent Matrix. With a sense of gravitas and anticipation, he prepared to unveil the next sophisticated level of exploration:

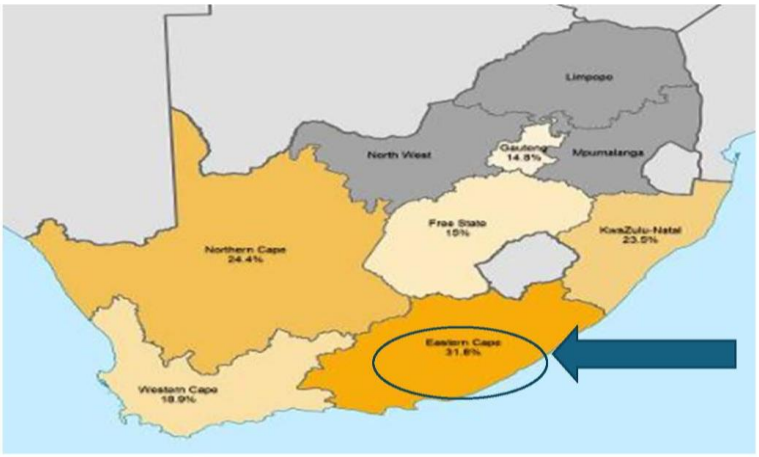
> In addition to *first-level quantitizing*, the Inter-Respondent Matrix can facilitate the two *second-level quantitizing* approaches, namely, *spatial-based quantitizing* and *time-based quantitizing*. Let us turn our attention to spatial-based quantitizing. Ynot, utilizing the Inter-Respondent Matrix, you analyzed the occurrence of each of the seven emergent themes based on (a) the province where each student resided during the study and (b) the province from which each student worked remotely. It is important to note that South Africa comprises nine provinces. Now, disaggregating these frequencies by province yielded yet another Matrix—a *Spatial-Based Matrix*—that captured one set of frequencies for each emergent theme. These frequencies for each emergent theme within each province served as what you have referred to in other works, such as Onwuegbuzie (2003), as *manifest effect sizes*—which, as I have noted previously, represent effect sizes that pertain to observable content.

Inhaling deeply, gathering both his thoughts and the Ynot's focused attention, Mixedmethodus seamlessly transitioned forward:

> This Spatial-Based Matrix for each emergent theme then was mapped onto the nine provinces. The next slide provides the manifest effect sizes pertaining to the Internet connection theme by the province where each student lived.

Mixedmethodus then advanced the next slide:

Slide 46: Manifest Effect Sizes Pertaining to the Internet Connection Theme by the Province Where Each Student Worked Remotely



Pausing for only a brief moment, Mixedmethodus stated:

> As can be seen from this slide, there is a markedly higher prevalence of students whose experiences fall under the Internet Connection theme, predominantly residing and working remotely from the Eastern Cape, more so than from any other province. This finding gains additional layers of complexity when considering that, despite its status as the second-largest province in South Africa, Eastern Cape also bears the distinction of being the most economically disadvantaged. Consequently, students operating remotely from the most economically challenged province, namely, Eastern Cape, were significantly more inclined to report difficulties pertaining to Internet connectivity compared to their counterparts in wealthier provinces.

With added enthusiasm, Mixedmethodus stated the following:

> Ynot, in a display of analytical innovation and driven by your enthusiasm in geographic information systems (GIS)—for which you have been a proponent of its use in mixed methods research, as evidenced by your article with the prolific Dr. Frels and her remarkable son, namely, J. G. Frels et al. (2011)—you further enriched the Spatial-Based Matrix by integrating an additional column. This column meticulously ranked each province by economic status, from Gauteng at Range = 1, marking it as the wealthiest, to Eastern Cape at Range = 9,

identifying it as the least affluent. This nuanced addition facilitated a compelling analysis, enabling you to draw a correlation—what you coined as a *spatial correlation* involving the use of a nonparametric correlation coefficient, namely, Spearman's correlation—between the spatial distribution of Internet Connection challenges among students working remotely across the nine provinces and the economic ranking of these provinces. The resultant spatial correlation coefficient of .44 for the Internet Connection theme represented a large effect size, using Cohen's (1988) criteria, highlighting a substantive relationship between provincial poverty levels and Internet connectivity issues. This spatial correlation, when visualized on the spatial map, not only aligns with our intuitive grasp of how socioeconomic status influences access to digital resources but also starkly illustrates the critical role that regional economic disparities play in shaping the remote learning environment.

Mixedmethodus turned towards Ynot, his gaze imbued with a deep sense of gratitude and admiration. In a moment filled with genuine acknowledgment, he eloquently expressed the following:

I have delved into three of the four foundational DIME-Driven quantitizing approaches: descriptive-based, inferential-based, and exploratory-based quantitizing. Let's now pivot to explore the utilization of the Inter-Respondent Matrix in facilitating the fourth DIME-Driven dimension—measurement-based quantitizing. In your groundbreaking collaboration with the esteemed Professor Vanessa Scherman—a project that both HalleBerryus and I have been observing with keen interest—you have masterfully demonstrated the application of Modern Test Theory (MTT) in analyzing quantitized themes through the Inter-Respondent Matrix. MTT, often discussed in contrast to Classical Test Theory (CTT), aims to unveil a deeper, more nuanced comprehension of both the test items and the individuals engaging with them. This is primarily achieved through two pivotal models within MTT: Item Response Theory (IRT) and the Rasch model. What sets your research apart is the innovative way that you employ IRT and the Rasch model to dissect and to understand further both the quantitized themes and the participants from whom the themes were generated. Your methodological creativity shines as you elucidate the utility of a Rasch analysis in pinpointing the themes' prevalence or rarity across responses, thereby revealing their relative difficulty or ubiquity. You further elaborate on how a 2-parameter IRT model not only maps out the theme prevalence but also gauges their efficacy in differentiating among participants' responses. The inclusion of a guessing parameter in a 3-parameter IRT model ingeniously accounts for the probability of themes emerging by chance. Finally, a 4-parameter IRT model offers insights into the saturation or the upper limits of theme occurrence across datasets. The Matrix stands as a cornerstone in the computational rigor required for parameter estimation and thorough data analysis within both Rasch and IRT paradigms. Having been privy to the advanced draft of your joint article with Professor Scherman—Scherman and Onwuegbuzie (in press)—I eagerly anticipate its forthcoming publication, confident in the contribution it promises to the scholarly dialogue on using the Matrix to enhance quantitizing approaches further.

With his hands momentarily clasped together, as if to gather his thoughts and the weight of his next words, Mixedmethodus then paused, allowing a brief silence to fill the space between him and Ynot. Then, he continued:

In exploring the nuanced landscape of second-level quantitizing, we have previously navigated the realms of spatial-based quantitizing through the innovative use of the Inter-Respondent Matrix. Now, let us turn our attention to another intricate facet of second-level quantitizing: time-based quantitizing. Although you have yet to embark on this journey within the context of your comprehensive COVID-19 series of studies, imagine the rich insights that could be unearthed if the same 1,932 participants had engaged in a longitudinal study, sharing their experiences at multiple junctures throughout their online learning odyssey during the COVID-19 pandemic. Picture these learners responding to the pivotal query, "What challenges are you experiencing that are hindering your ability to learn online during the COVID-19 pandemic?" not once, but thrice: initially in 2020, and subsequently at yearly intervals in 2021 and 2022.

By applying the methodical process of theme extraction—via topic modeling—and then translating these identified themes into a binary format within an Inter-Respondent Matrix for each of the 3 years, we could amalgamate these matrices into a singular, comprehensive Inter-Respondent Matrix. This consolidated Matrix, enriched with three layers of thematic data, would serve as a fertile ground for conducting profound time-based analyses.

Envision harnessing the power of *Logistic Regression for Repeated Measures* to unveil predictors of thematic prevalence, while meticulously accounting for the intricate correlation between repeated observations

of the same participant. Dive into the depths of *Survival Analysis*, a technique tailored for the dissection of time-to-event data, alongside its discrete-time counterpart that maps the likelihood of theme emergence within specified intervals. Picture employing *Generalized Estimating Equations* to decode the dynamic influence of predictors across the temporal expanse, or embracing the versatility of *Generalized Linear Mixed Models* (*GLMM*) to embrace the complexity of inter-participant variability with elegance. Furthermore, *Mixed Models for Binary Outcomes*, a specialized iteration of GLMM, offers a nuanced lens through which to analyze themes across time, capturing the essence of both fixed and random effects that delineate population-level trends and individual variations.

This envisioned journey through time-based quantitizing, rooted in the context of a global health crisis, not only would expand the horizons of methodological innovation but also would pave the way for a deeper, more textured understanding of the evolving challenges faced by learners in the throes of the COVID-19 pandemic.

Stepping gracefully into the limelight, HalleBerryus assumed her position at the forefront, embodying a presence that commanded attention. With a deliberate and serene poise, she fixed her gaze directly into Ynot's eyes, her expression softening into a warm, reassuring smile. In that moment, her smile served not just as a gesture of camaraderie but also as a silent testament to the depth of their shared Matrix journey and the anticipation of the insights she was about to unveil. Ynot, captivated by her confidence and warmth, waited in eager silence for the wisdom that she was poised to share:

Mixedmethodus and I have meticulously illustrated the profound capabilities of the Matrix, with a special emphasis on the Inter-Respondent Matrix, as a transformative tool for conducting a variety of intricate crossover mixed analyses. These analyses embody your visionary 1 + 1 = 1 integration approach, a concept you very thoughtfully introduced in 2017 (Onwuegbuzie, 2017) during a keynote address at the Mixed Methods International Research Association (MMIRA) conference that was held in Jamaica, which was organized by the legendary Professor Loraine Cook. Crossover mixed analyses, as you have defined, involve applying analytical techniques traditionally reserved for one research tradition, such as qualitative analysis, to data originating from another, such as quantitative data (Onwuegbuzie & Combs, 2010). This innovative methodological integration enables mixed methods researchers fully to leverage the Matrix's potential, transcending conventional research boundaries to uncover richer, more comprehensive insights. It is this groundbreaking approach that positions mixed methods researchers to harness fully the Matrix's unparalleled analytical power, paving the way for groundbreaking discoveries that enrich our understanding across diverse fields of study.

In a moment laden with anticipation, HalleBerryus's hands transformed into fists, tightly enveloping the mysterious contents she held within. With a deliberate and dramatic flair, she extended her arms forward, positioning her clenched hands so that they directed pointedly towards the floor of Ynot's bedroom. This gesture, simple yet imbued with intention, seemed to pull the very gravity of Ynot's gaze towards those hidden items, casting a spell of curiosity and suspense over the space. The air thickened with expectation, as if the very secrets of the universe were about to be unveiled right there, on the worn threads of Ynot's bedroom carpet.

HalleBerryus then presented to Ynot for a second time two distinct pills, one red and one blue. The red pill glowed softly, symbolizing the depth and context of qualitative research, whereas the blue pill shined with a crisp light, representing the precision and structure of quantitative research.

Softly, with a knowing smile, HalleBerryus declared:

> Ynot, again, the choice is yours. The red pill leads you down the rabbit hole of qualitative research, where context and depth await. The blue pill will guide you through the Pandora's box depicting the structured corridors of quantitative research. Choose wisely.

Ynot looked at both pills, reflecting on the gravity of his decision. With a resolute expression, he placed the red pill in his right hand and the blue pill in his left hand. HalleBerryus and Mixedmethodus both held their breath as he stared at both, contemplating the path that each pill represented.

After a moment of silent deliberation, Ynot brought both hands together, combining the red and blue pills. With a determined look, he swallowed them both simultaneously, signifying his refusal to accept a dichotomous choice and instead embracing an integrated research approach—consistent with the renowned Professor Burke Johnson's (2023) notion of adopting a *both/and stance*—also known as the *logic of combination*—as opposed to adopting an *either/or* stance.

Upon witnessing this bold act, HalleBerryus's smile broadened, her eyes sparkling with pride and approval. Mixedmethodus nodded in agreement, a look of respect and acknowledgment crossing his face.

In unison, and with enthusiasm, both HalleBerryus and Mixedmethodus exclaimed:

You are definitely The Next One!

They continued, their voices intermingling in a chorus of affirmation. HalleBerryus and Mixedmethodus explained:

You are now ready to showcase the power of the Matrix to the world, not only to mixed methods researchers, but also to both qualitative researchers and quantitative researchers alike.

Overwhelmed with a sense of purpose, Ynot punched the air with both fists, a symbolic gesture of his delight and determination. The energy in his bedroom shifted, charged with the promise of revolutionary insights and the potential to bridge worlds.

Ynot looked at HalleBerryus, the depth of his feelings for her evident in his eyes, but with a newfound resolve. Ynot declared passionately:

I will fulfill this mission. I will demonstrate the strength and versatility of the Matrix for integrating research approaches, leading to a more comprehensive understanding of the world.

The movie watchers, previously shrouded in thought, stared at the screen, inspired and galvanized by Ynot's words. A new resolve lit their faces.

In a moment of solidarity, Ynot transformed his hands into symbols of scholarly ingenuity. With his left hand, he meticulously crafted the shape of a "C," its curve elegantly signifying the left parenthesis of a Matrix. Mirroring this gesture, his right hand formed an inverted "C," representing the right parenthesis with equal grace. Together, these hand-formed symbols stood as the guardians of knowledge, ready to encase the rich tapestry of quantitative and qualitative data that weaved the essence of the Matrix.

With a flourish, Ynot raised both hands, aligning them side by side in a deliberate and meaningful display. This act, simple yet profound, visually encapsulated the unity of disparate data within the protective embrace of the parentheses, marking the boundaries of the Matrix with clarity and purpose.

In this defining moment, amidst the silent acknowledgment of his peers, the *Matrix Sign* was born! It emerged not just as a representation of methodological structure but as a beacon of integration, symbolizing the seamless fusion of qualitative and quantitative realms. This emblematic gesture, now forever etched in the annals of research methodology, served as a testament to the power of innovative thought and the boundless possibilities that lay within the realm of integrated mixed methods research.

As soon as Ynot executed the iconic Matrix Sign, in an electrifying instant, the very fabric of reality seemed to warp around him. A sleek, black leather coat materialized, cascading down his shoulders with an air of destiny, while a matching scarf—given to him as a gift by the world renowned Professor Sandra Schamroth Abrams—materialized, draped around his neck with a flair of mystique. This transformation was not just about attire; it was a declaration of his newfound identity and purpose within the Matrix.

HalleBerryus and Mixedmethodus, witnesses to this miraculous change, could barely contain their glee. Their voices, brimming with excitement and a hint of reverence, intertwined as they exclaimed in perfect unison:

Now you *look* like The Next One!

Their words echoed in the space around them, affirming Ynot's transformation and signaling the dawn of a new era in their struggle against the confines of the monomethod world.

As the final moments of the movie unfolded, the audience was utterly captivated, their eyes glued to the screen with an intensity that spoke volumes. Each scene, each line of dialogue, weaved a spell over the watchers, holding them in a rapturous embrace. Time seemed to stand still within the darkened theater, as the culmination of the story's journey of the Matrix reached its zenith. Hearts beat in unison, breaths were held in anticipation, and for these fleeting moments, nothing existed outside the compelling narrative playing out before them. The outside world faded away, leaving only the emotional resonance of the film's climax to fill the space between the screen and its beholders. As the movie drew to its inevitable close, it was clear that this cinematic experience had left an indelible mark on its audience, binding them together in shared wonder and reflection.

As the moment faded, the trio—Ynot, HalleBerryus, and Mixedmethodus—stood united, ready to embark on a journey that would challenge the conventions of research and open new horizons for inquiry and understanding.

The moment "The End" flickered into view on the screen, a wave of applause, cheers, and radiant smiles washed over the audience as if on cue. This outpouring of emotion was not just

a mere reaction; it was a testament to the collective exhilaration and profound connection that had been forged among the viewers through the journey of the film. Their response was as heartfelt as it was instantaneous, echoing the resonance of the story they had just experienced together. In that instant, the cinema was more than a room; it was a microcosm of shared humanity, celebrating not only the artistry of the film but also the indelible marks it left on their hearts and the unity it inspired among them.

As the thunderous applause and jubilant cheering gradually subsided, the cinema began to empty, with nearly every spectator rising to make their way toward the exits, their spirits lifted by the cinematic spectacle they had just witnessed.

Yet, amidst the departing crowd, Nelip and Ellah remained anchored in their front-row seats, an island of curiosity in the flowing stream of moviegoers.

Nelip, her interest piqued by a lingering thought, leaned closer to Ellah, her voice tinged with anticipation and intrigue:

You know, I am wondering whether this movie holds a secret similar to those Marvel masterpieces. Could there be one final scene that appears after the credits, which serves as a preview for the sequel?

Her words hung in the air, filled with the promise of undiscovered tales and the allure of continuing sagas, inviting Ellah into the mystery of what might lie beyond the curtain of credits.

As the last echoes of the movie's soundtrack faded into silence, the vibrant credits ceased their dance across the screen, plunging the theater into a momentary darkness. Nelip and Ellah, now

cloaked in an anticipatory hush, waited as the seconds stretched on, their breath held in collective suspense.

Suddenly, the void was pierced by the emergence of a figure on the screen, his gaze piercing through the dim light, connecting with the eyes of the few movie audience members savvy enough to linger. His voice, rich with resolve and laced with a chilling determination, broke the silence:

Why, Mr. Ynot? Why persist in this folly?....My name is Agent Myth. My name Myth stands for **M**aking up **Y**arns **T**riggering **H**ostility and, most importantly, it stands for **M**atrix **Y**esterday **T**omorrow **H**acked! I stand as the guardian of the reality you seek to unravel. Your quest to unveil the Matrix's strength and versatility for integrating research approaches is a threat to the monomethod order that has been established. Know this—I will marshal every Myth at my disposal, every shadow of doubt, to thwart your endeavors.

With these words, an ominous finality settled over the theater as the screen succumbed once again to darkness, leaving the words of Agent Myth to echo in the minds of those present.

In the silence that followed, Nelip and Ellah exchanged a glance, a silent communication passing between them. Their voices, brimming with anticipation and a shared thrill for what was to come, merged into a single declaration of eager expectation:

I cannot wait for the sequel!

Their words hung in the air, a testament to the stirring adventure that awaited them, as the promise of a continuation lingered on the horizon, igniting imaginations and setting hearts aflame with the possibilities of what lay beyond.

Notes

[1] This movie script was inspired by two keynote addresses conducted by Ynot in Trinidad and Turkiye, respectively—specifically, Onwuegbuzie (2023a, 2023b).

[2] The author wishes to thank Merve Göllü for the creation of the original illustrations relating to the original Matrix movie that appear in this article, contributing significantly to the clarity and impact of this article.

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