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Sampling as the Bridge between Paradigms: An Integrated Framework and Procedural Pathway for Mixed Methods Research in Education

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Abstract
Mixed methods research (MMR) has become an important technique of educational research, which serves as a bridge between the quantitative and the qualitative paradigm to tackle the complexity of the teaching and learning processes. Despite its increasing use, there has always been a difficulty; the lack of conceptual clarity and procedural consistency in the way sampling is designed and integrated across research strands. This weakness often affects data integration and the quality of inference in a study, as well as the overall methodology of the research. This research addresses this gap by developing an Integrated Framework and Procedural Pathway Model (IFPPM) that re-conceptualises sampling as the key link between philosophical foundations and research practise. The article considers the conceptual meaning of sampling in the framework of MMR, determines its main features and typologies that determine its application in different design structures. It further details a step-wise procedural pathway to assist coherent and transparent sampling decisions while emphasising on integration logic and the ethical considerations. By bringing together conceptual, procedural and ethical dimensions, the IFPPM allows a structure for researchers that is both structured and flexible. This study makes a contribution to strengthening the methodological rigor and coherence in educational research, as well as positioning sampling as an important integrative mechanism that enhances the credibility and depth of mixed methods studies.

Keywords: ***Mixed Methods Research; Sampling Integration; Educational Research; Sampling Design; Methodological Coherence; IFPPM Model; Research Integration***

1 Introduction

Mixed methods research (MMR) has become a prominent area of study in educational research as an increasing number of scholars have come to realise that complex educational phenomena cannot be adequately described using a single method of study. Contemporary educational environment is marked by multidimensional interactions involved with cognitive, social, cultural and institutional dynamics; hence, a combination of quantitative and qualitative approaches provide a more comprehensive ground to comprehend teaching, learning and evaluation processes (McCrudden et al., 2019; Plano Clark, 2019). By

integrating trends in numbers with contextualised and lived experiences, MMR helps researchers develop more depth and nuance in their research findings, which can contribute to both higher levels of explanation and higher levels of practical applications in educational research.

At the heart of MMR is the concept of integration - that is, the deliberate coupling of the qualitative and quantitative strands to reach coherent and meaningful inferences. Recent scholarship has underlined that the robustness of mixed methods studies is not only a function of whether or not we have more than one set of data types, but rather how successfully the two (or more) effective strands are integrated together at their various dimensions of design, data collection, analysis and interpretation (Fetters and Molina-Azorin 2020; Bazeley 2024). However, despite increasing improvements in the strategies of integration, one critical methodological issue remains: relative neglect of sampling as a major integrative element. Sampling decisions are treated in isolation in each strand leading to fragmentation that compromises coherence and the quality of meta-inferences (Onwuegbuzie & Collins, 2017).

Sampling in mixed methods research is not limited to the technical choice of participants but is inextricably connected with the philosophical and methodological foundations of inquiry. Grounded in a pragmatism and methodological pluralism, MMR calls for flexible but purposeful sampling strategies that correspond to research objectives and allow integration across paradigms (Shannon-Baker, 2016). While in quantitative traditions sampling focuses on representativeness and generalisability, in qualitative approaches, depth, context and saturation are more important. Within the framework of MMR, these logics have to be reconciled in order to achieve the level of complementarity, thus situating sampling as an important bridge that links breadth and depth and numerical patterns and experiential meaning (Palinkas et al., 2015).

The implications of badly-conceptualised sampling are huge. Inadequate alignment between sampling strategies across strands can compromise data integration and limit interpretive coherence, and ultimately, the overall rigor and trustworthiness of the study. As per the latest reviews of mixed methods practises, sampling design inconsistencies continue to be a persistent problem especially in educational research where a diversity of participant groups and variables in the context makes participant selection processes complicated (Zhou et al., 2023). Consequently, there is a strong need for a more systematic and theoretically based approach to sampling to include explicit support for integration.

Against this backdrop, the present study promotes the dual purpose. First, it conceptualises sampling as the operational link between the qualitative and quantitative paradigms in mixed methods educational research. Second, it proposes an Integrated Framework and Procedural Pathway Model (IFPPM) designed to help guide researchers in making coherent, transparent and methodologically sound sampling decisions. This model integrates philosophical assumptions, conceptual dimensions, procedural steps, and quality considerations into a unified structure for this model that aids in increasing theoretical clarity and practical application.

The importance of this work is in the contribution that it makes to strengthening the methodological coherence and rigour in educational research. By foregrounding sampling as a central, integrative process instead of a peripheral methodological step, this paper has much

to offer to those researching in the methodological sciences, to those in postgraduate studies, and to those who work in the education field and wish to design effective mixed methods studies. Ultimately, it places sampling not as a procedural necessity, but as a form of methodological craftsmanship essential to realizing meaningful integration and progress in knowledge in education.

2. Mixed Methods Sampling- Philosophical Foundations

The philosophical foundations of mixed methods research (MMR) offer the epistemological and ontological basis for how its sampling decisions are built. Unlike methods that are mono-methodical and tend to be anchored within one paradigm, MMR is able to operate within a space of a pluralistic philosophy that enables the integration of various ways of knowing. Central to this orientation is pragmatism, widely considered to be dominating philosophical underpinning of mixed method inquiry. Pragmatism puts the emphasis not on strict methodological allegiance, but on the research problem, on "what works" in addressing complex questions (Shannon-Baker, 2016). Within this framework sampling is not bound by any paradigm specific rules but rather informed by the purpose of the study, nature of the research questions and the requirement for meaningful integration across qualitative and quantitative strands.

Pragmatism allows for the use of both probability-based and purposive sampling strategies in ways that allow for both breadth and depth of understanding. Quantitative sampling, which is traditionally seen with the notions of representativeness and generalizability, and qualitative sampling, which is geared toward depth and contextual richness, are not considered incompatible but complementary elements to an overarching research design (Palinkas et al., 2015). Consequently, sampling in MMR becomes a strategic and adaptive process by matching methodological choices and practical research goals. This flexibility is especially important in educational research, as the varied populations, the variability of contexts, and the complexity of phenomena require nuanced and context-sensitive sampling approaches.

In addition to pragmatism, there is also the dialectical stance, a critical philosophical lens upon which to understand mixed methods sampling. Rather than dissolving the tensions between the paradigms, the dialectical approach recognizes and deliberately works with tensions between the paradigms. It accepts that quantitative and qualitative paradigms are based on differing assumptions regarding reality and knowledge, but believes that the interaction between them can lead to more comprehensive insights (Biddle & Schafft, 2015). Within this view, sampling is not simply a procedural task, but a place of integration, in which such paradigmatic differences are negotiated. For example, a study may use probabilistic sampling to find broad patterns among students and at the same time use purposive sampling to get in-depth experiences of selected students. The dialectical position therefore favors that there is dynamic divergence and convergence sampling logic.

Epistemological flexibility is an additional reason for the philosophical foundation of mixed methods sampling. MMR presumes that knowledge can be built and viewed through many lenses and no single method has a monopoly on the truth. This view helps to legitimize the use of hybrid sampling designs, which combine or sequence different techniques at different phases of research. For example, in exploratory designs, qualitative purposive sampling

methodology can be used to start with to gain insights, and then quantitative sampling methodology can be used to test emerging patterns, whereas in explanatory designs the opposite may be true. Such flexibility permits sampling to change in an iterative manner based on emerging findings in a manner that promotes coherence and responsiveness in the research design (Onwuegbuzie & Collins, 2017).

Importantly, sampling in MMR is an act that should be understood both as epistemic and as a practical act. Epistemically, it is the assumptions a researcher has about the nature of valid knowledge and how that knowledge can be accessed. Practically, it means making concrete decisions about who/what belongs in the study, how people are to be selected for the study, how different samples relate to one another by strands. These dual dimensions highlight the importance of sampling in determining what data are collected and the ways in which these data are interpreted and inferences are made. As such, sampling decisions need to be explicitly tied to the overall logic of inquiry, and make sure they support the intended form of integration and study's overall purpose.

The philosophic underpinnings of mixed methods sampling are placed within the pragmatism, enriched by dialectic, and made possible through epistemological flexibility. Together, these perspectives help situate sampling as a dynamic, integrative process that enables a cross-fertilization of paradigms and a correspondence between methodological choices and research goals. By locating sampling in this philosophical context, researchers can go beyond isolated practices towards more coherent and theoretically grounded mixed methods designs that increase both rigor and relevance in educational research.

3. Conceiving Sampling in Mixed Methods Educational Research

Sampling in mixed methods research (MMR) in educational settings needs to be conceived as a conceptual blended process crossing the boundary of qualitative and quantitative research paradigms. Rather than seeing sampling as the discrete and procedural step that is limited to separate strands, current scholarship places sampling as a core design feature that influences the coherence, integration, and inferential power of mixed methods studies (Onwuegbuzie & Collins, 2017). In educational research, with its inherently complex and context-dependent phenomena, sampling plays a pivotal role in how different forms of evidence are generated, connected and interpreted (Alordiah & Oji, 2024).

From a paradigmatic perspective, there are differences historically between the conceptualizations of sampling among methodological traditions. Quantitative sampling is based on the concept of probability theory and is focused on representativeness, generalizability, and statistical inference. Techniques such as random, stratified and cluster sampling is used to ensure that the findings can be generalized to wider populations. In contrast, qualitative sampling is driven by the focus of purposiveness, relevance to the theory, and the concept of saturation, and are interested in depth, meaning, and contextual understanding (Alordiah et al., 2023; Palinkas et al, 2015). These divergent logics have often resulted in disjointed sampling practises in mixed methods studies, in which each strand is designed separately without giving adequate thought to how they are related to each other.

However, recent methodological advances state that in MMR, sampling should not only juxtapose these approaches but should integrate both to achieve complementarity and

coherence (Plano Clark, 2019; Fetters & Molina-Azorin, 2020). Conceptually, it means that sampling needs to be in harmony with the overall purpose of the study and the proposed mode of integration. For example, in the case of a convergent design, quantitative and qualitative samples can be drawn simultaneously to describe the same phenomenon from different perspectives, and the samples need to be carefully aligned either in terms of participants, context, or the units of analysis. In sequential designs, sampling decisions in one phase often inform and shape decisions in the next phase, and there is a dynamic and iterative relationship between strands (Guetterman & Fetters, 2018).

Within educational research this integrated conceptualization of sampling is especially important. Studies of effectiveness of teaching, engagement of students or policy implementation often need both the scale of data to detect patterns as well as depth of understanding to understand underlying mechanisms. For example, a researcher may take a probability sample of students to determine academic performance trends and then select some of those students or teachers for purposive sampling to investigate contextual issues affecting academic performance trends. In such cases, sampling becomes the mechanism by which breadth and depth are being intentionally linked, to allow for richer and meaningful interpretation (McCrudden et al., 2019).

To further clarify this integration, a number of important concepts have been introduced in the mixed methods literature. "Participant selection" and "case selection" refer to how individuals or units are selected within and between strands, while "integration points" refer to the phases at which sampling decisions intersect - during the design, data collection and/or analysis of the study (Fàbregues et al., 2024). Also, the idea of "sampling legitimation" emphasizes the importance of justifying sampling choices in relation to both paradigmatic requirements and the overall logic of the study as a whole in order to ensure transparency and methodological rigor (Onwuegbuzie & Collins, 2017). These concepts together support the idea that MMR sampling is not only technical, but also not technical at all because it involves thinking deeply about how the sampling works in conjunction with the research aims and integration strategies.

Moreover, today discussions of mixed methods sampling stress that sampling should be considered a continuum rather than dichotomous. Instead of setting quantitative and qualitative approaches in a dichotomous fashion, the scholars have called for hybrid and adaptive approaches of sampling and address the needs of the process as it evolves. Instead of framing quantitative and qualitative approaches as polar opposites, academics have advocated for hybrid and adaptive methods of sampling and meet the needs of the process as it evolves (Palinkas et al., 2015). This view is especially applicable in educational contexts, in which researchers often work with a range of people in changing circumstances, and flexible and context-sensitive sampling designs are required.

The conceptualization of sampling in mixed methods educational research also suggests a move away from traditional paradigm-bound definitions of sampling towards an integrated, purpose-driven understanding of sampling. Sampling functions as a connective mechanism that bridges the gap between quantitative representativeness and qualitative depth, between design and implementation, and facilitates meaningful integration across the research strands. By foregrounding these conceptual dimensions, researchers can develop mixed methods

studies that are not only methodologically sound, but are also able to capture the full complexity of educational phenomena.

4. Characteristics of Sampling Mixed Methods Designs

Sampling in mixed methods research (MMR) is marked by a series of defining characteristics of a flexible, integrative and design-dependent approach to sampling. Unlike sampling in mono-method studies, which is often informed by one epistemological logic, mixed methods sampling works across the boundaries of qualitative and quantitative traditions of knowledge, where a deliberate effort is needed to coordinate both traditions for coherence and rigour. These characteristics highlight the role of sampling, not only as a technical procedure but either as a dynamic process that is directly involved in integrating, inferring, and the overall quality of research in educational inquiry.

One of the most basic features of mixed methods sampling is duality of logic, which involves striking a balance between principles of representativeness and generalizability of quantitative study and depth, contextual richness and saturation of qualitative study (Palinkas et al., 2015; Onwuegbuzie & Collins, 2017). Rather than giving primacy to one logic over the other, MMR calls for researchers to join together in reconciling these approaches in ways related to the purpose of the study. This dual orientation allows researchers to capture both general patterns and subtle experiences, thus increasing the explanatory power of educational studies (McCrudden et al., 2019).

Closely related to this duality is designing dependence of sampling. In the case of MMR, sampling strategies are not determined separately but are inherently affected by the selected research design such as convergent, explanatory sequential, exploratory sequential or embedded designs (Plano Clark, 2019; Guetterman & Fetters, 2018). For instance, in explanatory sequential designs, initial quantitative sampling may be informative for subsequent qualitative sampling, while in convergent designs then, both may involve parallel sampling strategies, to be later integrated. This dependency speaks to the need for sampling decisions to be coordinated with the timing and priority and interplay of strands in the overall research architecture.

Another important feature is flexibility and adaptability. Mixed methods sampling is not usually static but is a changing process as the study progresses. Researchers may revise or modify sampling strategies based on the emerging findings, especially in the sequential design where the preliminary findings may inform the subsequent phases (Henrys et al., 2024; Onwuegbuzie & Collins, 2017). This adaptive quality is consistent with the pragmatics of the MMR, which means that the methodology allows researchers to respond to the complexities of educational settings while staying coherent as to methodology (Shannon-Baker, 2016).

A defining characteristic of mixed methods sampling is the integration-oriented characteristic. Sampling decisions are made not only to support the needs of individual strands but also in order to support meaningful integration across strands. This involves identifying whether samples are identical, parallel, nested or sequentially linked and identifying points where data from different samples will be combined or compared with each other (Fetters & Molina-Azorin, 2020; Akerblad et al., 2021). Effective Integration requires

careful alignment of sampling units, contexts, and participant characteristics to ensure that the data can be meaningfully connected during analysis and interpretation (Bazeley, 2024).

In addition, mixed methods sampling is characterised by being relational in nature with respect to the relationship between the samples of each strand. This can be by using the same participants in qualitative and quantitative phases, using two different but related samples or embedding one sample within another (Onwuegbuzie and Collins, 2017; Onwuegbuzie & Corrigan, 2021). These relationships are important in deciding the power of integration and the validity of meta-inferences, especially in educational research where there are usually many involved stakeholders and levels of analysis.

Another important characteristic is multi-level and context sensitivity. Educational research often involves hierarchical structures - for example, students in classrooms, classrooms in schools - which means the use of sampling strategies that take into account multiple levels of analysis. Mixed methods sampling is therefore often aimed at capturing these complexities by combining techniques that reflect both macro level patterns, as well as micro level experiences (Fröhlich et al., 2020). This sensitivity helps make findings based on contextually grounded and analytical robustness.

Furthermore, mixed methods sampling involves emphasising the methodological coherence and legitimation. Researchers are expected to explain their sampling choices with respect to the purpose, design, and integration strategy of the study to be transparent and rigorous (Fàbregues et al., 2024). The notion of sampling legitimation emphasises the importance of addressing possible weakness that arises from the amalgamation of different sampling logistics and show how they are addressed in the study design (Onwuegbuzie & Collins, 2017).

Ethical considerations are also one of the defining characteristics, especially the principle of ethical inclusivity. Mixed methods studies in education tend to involve diverse populations, such as marginalised or under-represented groups. Sampling therefore needs to create equitable representation and prevent any biases that may skew any findings or exclude important perspectives (Mertens, 2024). This ethical dimension reinforces the responsibility of researchers to develop sampling strategies that are methodologically sound and socially just.

Additionally, mixed methods sampling is characterized by purpose-driven orientation where all the sampling decisions are explicitly related to research questions and the intended outcome. Whether the objective is triangulation, complementarity, development or expansion, sampling strategies need to be tailored to support such objectives (Fetters & Molina-Azorin, 2020). This alignment makes sure that sampling contributes directly to the study's integrative aims and thus does not serve as a disconnected procedural step.

Finally, mixed methods sampling has integration visibility and transparency; that is, researchers need to provide documentation about how samples are selected, related, and integrated across strands. The use of tools such as joint displays and sampling rationale tables have been suggested to increase clarity and aid in understanding how sampling is used to support integration (Fetters & Tajima, 2022). Such transparency is necessary to consider quality and credibility in mixed methods research.

5. Types of Mixed Methods Sampling

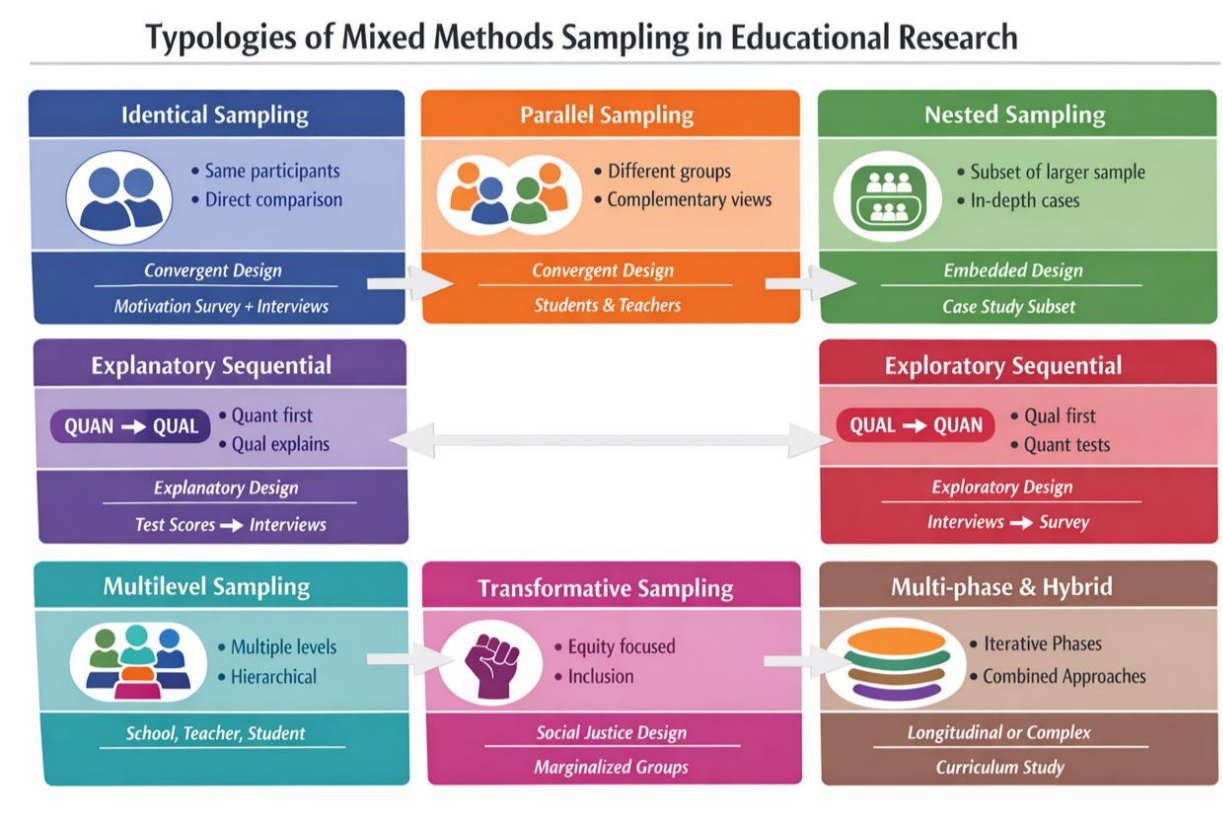

Figure 1: **Typology of Mixed Methods Sampling in Educational Research**

The complexity of mixed methods research (MMR) requires the elaboration of clear typologies that inform the way the sampling is structured, related and integrated in both qualitative and quantitative strands. Typologies of mixed methods sampling offer a systematic method of understanding how different sampling strategies may be combined to support specific research purposes, designs, and integration goals. Rather than arbitrary, these typologies are grounded in the logic of inquiry, the timing of data collection and the relationships between samples, and thus constitute an important part of methodological coherence (Onwuegbuzie & Collins, 2017; Plano Clark, 2019).

At a basic level, mixed methods sampling can be divided into basic typologies, which represent the basic compositional relationship between qualitative and quantitative samples. One such type is identical sampling where the same participants are involved in both the strands of the study. This approach allows for direct comparison and integration of data which makes it particularly appropriate for convergent designs where researchers attempt to corroborate data across methods (Fetters & Molina-Azorin, 2020). In the field of educational research, this could mean conducting a survey of a group of students, and then interviewing the same people to get a better understanding of their answers.

A second basic type is the parallel (or independent) sampling, in which different samples are selected for the quantitative and qualitative strands. While these samples could be distinct, they are usually taken from the same population or context, in order to ensure comparability. Parallel sampling has usefulness in which the research goals to delve into the complementary

aspects of a phenomenon without needing direct linkage between individual participants (Guetterman & Fetters, 2018). For instance, a researcher might survey a large population of students, but interview a smaller population of teachers to get different perspectives on classroom practices.

Another well-known typology, called nested (or embedded) sampling, is when one sample is contained within the other. This way it can be possible to combine detailed qualitative insights into a wider quantitative framework or vice versa. Nested sampling is especially useful in embedded designs, where a particular strand of the method underlies the other strands of a study (Plano Clark, 2019). For example, a researcher can choose a smaller sample of students from a larger sample of students surveyed to conduct in-depth case studies, which connects macro-level trends and micro-level experiences.

Beyond these basic forms, sequential sampling typologies are determined by how and when data are collected. In the explanatory sequential sampling (QUAN --> QUAL) approach in which quantitative data are gathered and analysed first, followed by qualitative sampling that are intended to explain or elaborate the first results. This is a common approach in educational research where statistical findings need to be contextualised, for example, by investigating the reasons for why particular instructional strategies produce particular findings (McCrudden et al., 2019). On the other hand, exploratory sequential sampling (QUAL --> QUAN) starts with qualitative data to provide insights or hypotheses and tests or generalises these through further quantitative sampling. This typology is especially helpful when conducting studies of emerging or under-researched educational phenomena (Palinkas et al., 2015).

In addition to these, more complex and advanced typologies have been identified in order to tackle the many facets of contemporary educational research. Multilevel sampling is the process of selecting participants at different levels of a system, such as students, teachers, and school administrators, as a way to study relationships between systems and contexts (Fröhlich et al., 2020; Zimano & Chilunjika, 2019). This is especially relevant in education where learning outcomes are shaped by institutional structures that are embedded within other institutional structures. Similarly, multi-phase sampling goes a step further and sequentially extends such approaches across several phases, allowing iterative improvement of samples and research questions as the study progresses (Chandanabhumma et al., 2024; Onwuegbuzie & Collins, 2017).

Another new typology is transformative sampling that is driven by ethical and social justice issues. Rooted in transformative and critical paradigms, this approach focuses on the inclusion of marginalized or underrepresented groups and aims to address inequities in educational research (Mertens, 2024). Transformative sampling emphasizes the fact that methodological choices are not value-neutral but are situated in larger social and ethical contexts.

Importantly however, these typologies are not mutually exclusive. Mixed methods studies often utilize hybrid or combined strategies of sampling designed to their specific design and purpose. The selection of typology is based on a number of factors, such as the research questions and the type of integration (e.g., triangulation, complementarity, development) sought, and practical limitations of the study (Fàbregues et al., 2024). As such, researchers

need to make considered and transparent choices about the selection and implementation of sampling types to make sure that they are consistent with the overall research design.

Table 1
Comparative Typology of Mixed Methods Sampling in Educational Research

Sampling Type	Purpose	Sampling Logic	Design Fit	Educational Application Example
Identical Sampling	To enable direct comparison and integration of quantitative and qualitative data from the same participants	Same individuals serve both strands; alignment ensures strong integration and meta-inference	Convergent designs; some embedded designs	Surveying students on academic motivation and interviewing the same students to explain their responses
Parallel (Independent) Sampling	To explore complementary perspectives from different participant groups	Different samples drawn from the same population or context; comparability without direct linkage	Convergent designs; multi-source studies	Surveying students while interviewing teachers about classroom engagement
Nested (Embedded) Sampling	To link detailed insights within a broader dataset	One sample is a subset of another; allows depth within breadth	Embedded designs; explanatory designs	Selecting a subset of survey respondents for case study interviews
Explanatory Sequential Sampling (QUAN → QUAL)	To explain or elaborate quantitative findings using qualitative data	Initial probability sampling followed by purposive sampling based on results	Explanatory sequential design	Using test score data to identify high/low performers, then interviewing selected students to understand differences

Exploratory Sequential Sampling (QUAL → QUAN)	To develop instruments or hypotheses from qualitative insights and test them quantitatively	Initial purposive sampling followed by probability sampling for generalization	Exploratory sequential design	Conducting interviews on teaching strategies, then designing a survey to test findings across schools
Multilevel Sampling	To capture interactions across hierarchical educational structures	Sampling occurs at different levels (e.g., student, classroom, school)	Multilevel mixed methods; complex designs	Studying student achievement (student level), teacher practices (classroom level), and policy (school level)
Multi-phase Sampling	To allow iterative refinement of sampling across multiple stages	Sequential and adaptive sampling across several phases	Longitudinal or multi-phase designs	Evaluating curriculum reform over time with repeated sampling of students and teachers
Transformative Sampling	To ensure inclusion of marginalized or underrepresented groups and address equity issues	Purpose-driven, often purposive or critical sampling guided by social justice goals	Transformative mixed methods designs	Focusing on experiences of minority students in inclusive education programs
Hybrid/Combined Sampling	To maximize flexibility and integration across complex studies	Combines multiple sampling types (e.g., nested + sequential)	Complex, adaptive designs	Using survey data, followed by nested interviews and later expanded sampling for policy evaluation

6. Procedures and Decision Pathways for Mixed Sampling

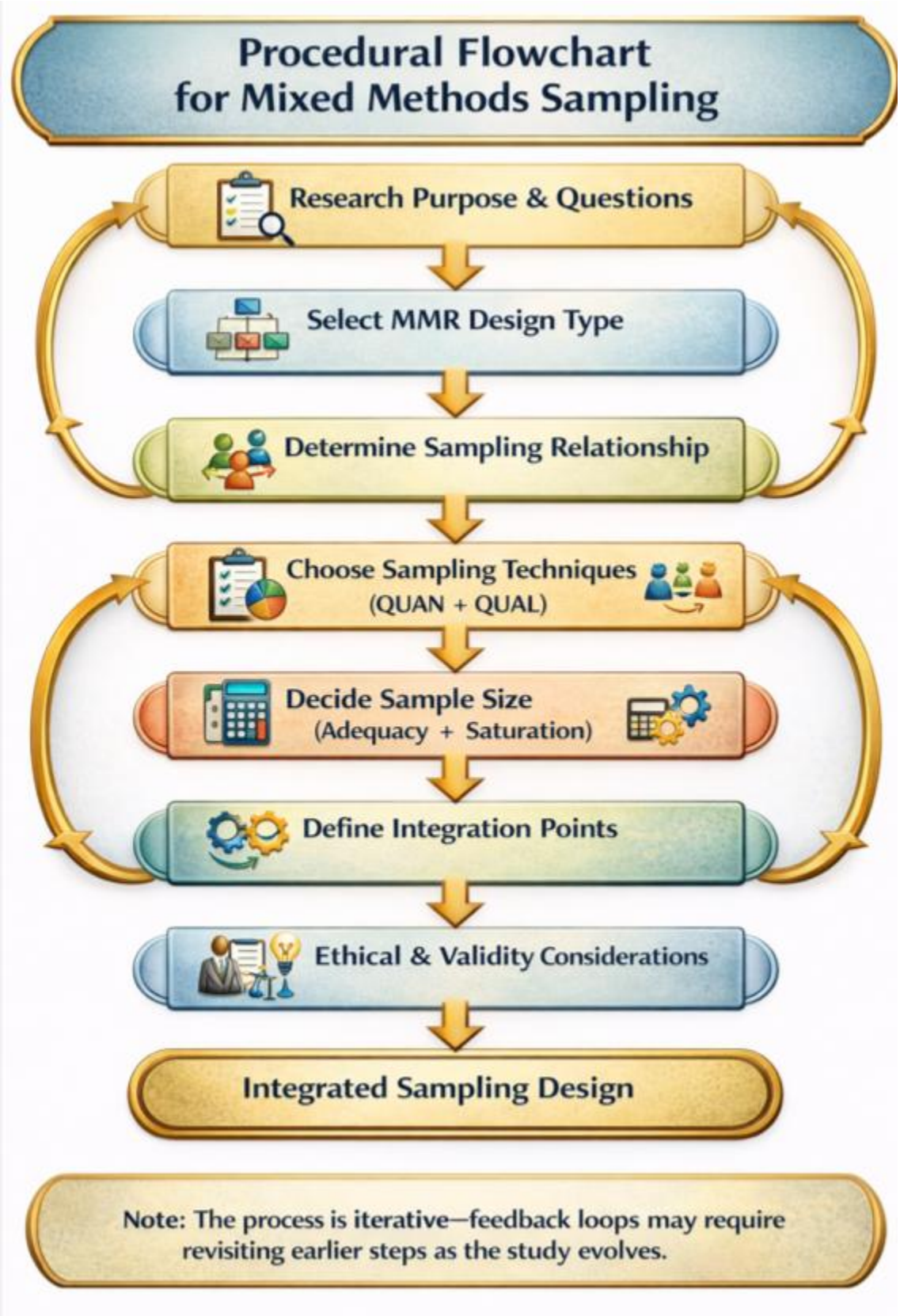

Figure 2: **Procedures and Decision Pathways for Mixed Sampling**

Designing sampling in mixed methods research (MMR) calls for a planned-yet flexible-pathway, which incorporates philosophical logic and practical decision-making. Within the complexity of the combination of qualitative and quantitative methodologies, sampling should be considered as a sequential and iterative process that guarantees matching to the purpose of the research, design and integration objectives (Haynes-Brown, 2025; Plano Clark, 2019; Fetters & Molina-Azorin, 2020). The following procedural pathway is a coherent guide for researchers working in mixed methods research when the research is educational.

Step 1: Understand the Research Purpose and Research Questions

The starting point for mixed sampling involves a good articulation of the research purpose and questions. Researchers need to decide whether the study is an exercise in triangulation (helping to corroborate findings), complementarity (helping to develop understanding), development (informing later phases) or expansion (helping to broaden the scope of inquiry). These intentions directly influence the way that sampling will be structured across strands (Plano Clark, 2019). For example in triangulation there frequently has to be similar samples whereas in development there may have to be sequentially-linked samples.

Step 2: Choose Mixed Methods Design Type

The choice of design, that is convergent, explanatory sequential, exploratory sequential, embedded, or transformative creates the structural blueprint for sampling decisions. Each design determines when and with what priority sampling will take place along each of the strands (Guetterman & Fetters, 2018). For example, the design of convergent designs requires simultaneous sampling and sequential designs require phased sampling, by which one informs the other.

Step 3: Establish Sampling Relation

At this stage, researchers determine the relationship between samples from different strands:
Same (identical) participants),
Relationship of nesting (subset), or
Parallel/different (different but related groups).
This decision is important in integration because it controls the extent of comparability and linkage between datasets (Onwuegbuzie & Collins, 2017).

Step 4: Choose Sampling Techniques for Each Strand

Researchers then identify suitable methods for each strand of methodology:
Quantitative sampling: Random, stratified, Cluster Sampling (representation ensured).
Qualitative sampling: Purposive, Maximum Variation, Snowball or Theoretical Sampling (Depth and Relevance).
The important thing is not simply choosing techniques between them, but having them come together for the study's integrative purpose (Palinkas et al., 2015).

Step 5: Decide on Sample Size

Sample size determination in MMR is a balancing of two different logics;
statistical adequacy with respect to quantitative strands (power, generalisability), and
Saturation and information richness for the qualitative strands.
Rather than dealing with these separately, researchers have to justify the contribution of both to the overall quality of the inference (Onwuegbuzie & Collins, 2017).

Step 6: Concentrating on Integration Points

Sampling decisions need to explicitly take into account where and how integration will take place. Integration points can occur at:

Data collection (e.g. choosing interview participants from respondents to survey),

Data analysis (e.g. combining datasets), or

Interpretation (e.g. comparison of findings).

Clear presentation of such points enhances methodological coherence and transparency (Fetters & Tajima, 2022).

Step 7: Make Sure the Ethical and Validity Issues

Finally, sampling should be conducted with both an ethical and a methodological rigour. This includes:

Ensuring the inclusive representation of diverse educational stakeholders, and

Transparency of sampling decision, and

Dealing with sampling legitimation (justifying integration and reducing bias).

Ethical and validity considerations are not the final stages and should not be considered as such, but rather provide a basis that informs every step that precedes it (Mertens, 2024; Fagregues et al., 2024).

7. The Integrated Framework and Procedural Pathway Model or IFPPM

Purpose

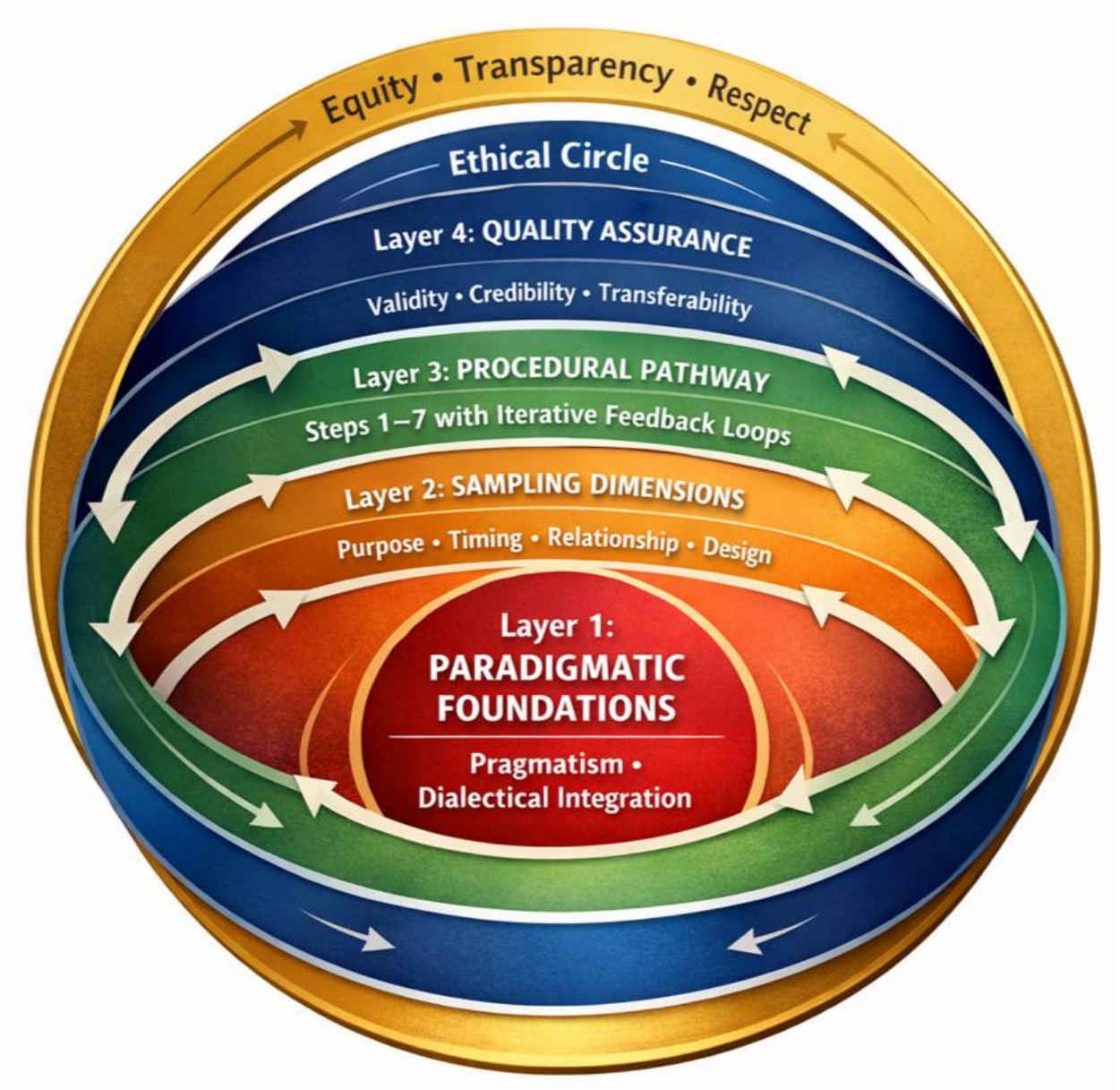

Figure 3: **The Integrated Framework and Procedural Pathway Model or IFPPM**

The Integrated Framework and Procedural Pathway Model (IFPPM) is the key contribution of this study. It offers an in-depth structure to bring together philosophical foundations, conceptual dimensions, procedural steps and quality considerations into a consistent model for mixed methods sampling in educational research. The IFPPM locates the sampling as the operational bridge from why research is done (design logic) to how research is done (procedural practice).

Model Structure

The IFPPM is designed as a multi-layered and dynamic system that is composed of five related layers:

Layer 1: Paradigmatic Basis

This underlying layer is based on the following:

Pragmatism (what works in addressing research problems), and

Dialectical integration (engaging and reconciling paradigm differences).

These perspectives provide the rationale for using hybrid sampling strategies and deciding from within the model (Shannon-Baker, 2016).

Layer 2: Sampling Dimensions

This layer specifies the important conceptual elements that determine sampling:
Purpose (triangulation, complementarity, expansion),
Timing (concurrent versus sequential),
Relationship (identical, nested, parallel),
Design alignment.
These dimensions are a translation of philosophical assumptions into design considerations that can be put into action.

Layer 3: Procedural Sequence

This layer operationalizes the sampling through the seven step pathway described above. It offers a systematic yet flexible procedure that guarantees that there is alignment between research objectives and sampling implementation.

Layer 4: Quality Assurance

This layer guarantees the use of methodological rigour through:
Validity (accuracy of inferences), and
Credibility (trustworthiness of qualitative insights), and
Transferability (applicability of context).
Sampling decisions are considered in terms of how well they meet these quality criteria (Fàbregues et al., 2024).

Layer 5: Ethical Circle

Surrounding all layers is the ethical dimension which emphasises:
Equity,
Transparency,
Respect for participants.
This circular representation represents that ethics is a continuous influence in all aspects of sampling, as opposed to being a discrete step.

Description of the Model

The IFPPM conceptualise sampling as a dynamic and iterative link between a research design logic and procedural implementation. Rather than a strictly linear process, sampling decisions are made as part of a system of feedback loops in which each sampling choice has an influence and is influenced by other elements of the research design. For example, initial decisions on sampling due to research purpose may have to be revised considering integration points or ethical implications.

This dynamic interaction reflects principles in the theory of Complex Adaptive Systems in which components of a system interact constantly and change in response to their internal and external conditions. In the case of MMR, sampling is not static, but is adaptive and depends on emerging data, on contextual limitations, as well as on a changing understanding of research results.

The IFPPM promotes mixed methods sampling from its position as a marginal methodological step to its status as a central integrative mechanism. By establishing the connection between philosophical assumptions, conceptual clarity, procedures, quality

assurance, and ethical responsibility in one framework, the model gives sampling a thoughtful and coherent character. In doing so, it moves the position of mixed methods research in education from methodology combination to methodology craftsmanship, which can solve the complexity of real-world educational phenomena.

8. Considerations and Guidelines for Good Practice

The effective implementation of mixed methods sampling demands not only a conceptual clearness but also the use of practical strategies that enable the coherent, transparent, and rigorous development of the research process. Given the complexity in integrating the qualitative and quantitative approaches, researchers must follow deliberate practises that align the sampling decisions with the overall logic of inquiry.

One of the first issues is how to justify mixed sampling in proposals, theses and journal publications. Researchers should directly state the reasons for sampling strategy combinations by relating them to research purpose and design. This includes demonstrating how the sampling approach chosen supports integration whether that is triangulation, complementarity, development or expansion, and how it enhances the depth and breadth of findings. Clear justification should also be given for why single method sampling would not suffice, and thereby position mixed sampling as a methodological necessity rather than the procedural add-on that it currently is.

Retaining the coherence of sampling across designs (especially sequential and convergent studies) is equally as important. In the case of sequential designs coherence is achieved in the sense that sampling in the second phase logically builds upon the first, such as qualification participants based on quantitative results in explanatory designs. In convergent designs it is required that coherence is achieved through alignment in population, context, or units of analysis in order to meaningfully compare and integrate datasets. Researchers are thus forced to plan sampling relationships ahead of time, but be open to changing them as the research develops.

Another important practice is open documentation of the integration of sampling. This can be done through such tools as sampling rationale tables, joint displays and methodological flow diagrams. These tools enable researchers to clearly present ways in which samples were chosen, how samples relate to each other across strands and where integration occurs. Transparent documentation not only increases the methodological credibility, it also increases reproducibility and evaluability of mixed methods studies.

To assist the researchers the below checklist offers a brief guide to ensuring that a high-quality sample of mixed methods is used for educational research:

Checklist of Mixed Methods Sampling

1. Does sampling decisions make clear sense in terms of research questions and purpose?
2. Are sampling procedures clearly identified and explained?
3. Are different and relevant participant groups represented fairly?
4. Is it clear the way samples are connected and integrated across strands?

Validity Justification Are sampling decisions related to the credibility and robustness of findings?

9. Methodological and Ethical Implications

The conceptualization and implementation of coherent sampling in mixed methods research have important methodological/ethical implications. From a methodological perspective, well-designed sampling provides for rigour and quality of inference, and trustworthiness of research. When the sampling strategies are aligned between strands and linked effectively, it assists in building more effective meta-inferences by having quantitative patterns and qualitative insights meaningfully linked. On the other hand, a badly aligned sampling may result in fragmented results, poor integration and low explanatory power.

Coherent sampling also plays a role in validity and legitimation of mixed methods research. By explicitly addressing the selection of samples, the relationship between samples, and the integration of sample information, researchers can reduce potential biases and establish the robustness of their conclusions. This is especially important in educational research where different contexts and characteristics of participants can have a major impact. Transparent and well-founded sampling choices are therefore a basis for credible and defensible research results.

Beyond methodological issues, sampling raises important ethical issues, especially those concerning equity, fairness and respect for the context. Educational research is apt to have participants with different socio-cultural, economic and institutional backgrounds, including those of marginalized or underrepresented groups. Ethical sampling requires conscious efforts to ensure that these voices are included and represented properly and that no one is excluded or their voices misrepresented. This fits into wider promises of social justice and inclusivity in educational research.

Furthermore, researchers must take into consideration contextual sensitivity of sampling decisions. The lack of attention to cultural, institutional or situational context in the selection of participants may result in misinterpretation of the results and ethical issues. Respect for the participants experiences, identities, and environments should therefore be considered as a guide to sampling practises at all stages of the research process.

In light of these considerations, there is a need for institutional review and reporting standards that are specific to mixed methods sampling. Ethics committees and journal reviewers should require clear documentation of sampling rationale, integration strategies and ethical protections. Standardized reporting guidelines, including the reporting of sampling justification tables and integration descriptions, can help improve the consistency, transparency, and quality of mixed methods studies in education.

10. Conclusion

This study has helped to advance the main argument of this central idea that sampling is not a peripheral methodological step but the operational bridge that relates the philosophical, methodological and procedural dimensions of mixed methods research. By placing sampling in the center of integration the paper emphasizes the importance of sampling to achieving coherence, rigor and meaningful interpretation of educational inquiry.

There are several important contributions that arise from this work. First, the research has given greater clarity to the conceptual meaning of sampling in mixed methods research

beyond traditional paradigm-bound definitions and toward an integrated and purposeful understanding. Second, it has charted the typologies and procedures by which mixed sampling can be undertaken and offers researchers a guide on how to structure coherent sampling strategy and procedure. Third, the paper has introduced the Integrated Framework and Procedural Pathway Model (IFPPM), which brings together the philosophical foundations, conceptual dimensions, procedural steps, quality assurance and ethical considerations into one consolidated model.

While the IFPPM is a powerful conceptual and practical framework, the full potential of the IFPPM is in empirical validation. Future research should apply and test the model in varied educational contexts to examine the effectiveness of this model in terms of integration, quality of inference, and methodological rigour. Such applications will not only improve the model but also help to further develop mixed methods research.

Ultimately, this study ends up having one reflective insight: coherent sampling is not just methodological convenience but methodological craftsmanship. By adopting a critical, integrative, and ethically grounded approach to sampling, educational researchers can create studies that are not only methodologically sound but also deeply attuned to the complexity of educational phenomena.

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