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Decision tree for identifying pertinent integration procedures and joint displays in mixed methods research

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Abstract

Aims: To propose a decision tree for identifying appropriate integration procedures and joint displays for achieving integration in mixed methods studies.

Design: A methodological discussion.

Data Sources: Methodological literature including mixed methods textbooks, methodological reviews and studies published in the last 10 years (2012–2022).

Implications for Nursing: Mixed methods are instrumental to study complex nursing care processes and health-human phenomena. Nurse researchers can use this decision tree to choose the most appropriate integration procedures to overcome the integration challenge when designing and conducting mixed methods nursing studies.

Conclusion: Integration procedures and joint displays are the most widely used methods for tackling the integration challenge in mixed methods research (MMR). The multifaceted and contingent nature of these methods are beneficial for their tailored and adapted use at the data collection, analysis, interpretation and reporting levels. The use of the most pertinent integration procedures and joint displays is critical for ensuring quality in MMR.

Impact: A growing methodological literature on MMR offers a wide range of integration procedures and techniques. Therefore, choosing appropriate integration procedures and analysis methods can be challenging for nurse researchers interested in conducting mixed methods studies. A decision tree is developed outlining 14 integration procedures and their corresponding mixed methods designs, purposes and joint displays. Examples of mixed methods studies in the discipline of nursing are presented to illustrate the implementation of the integration procedures. The decision tree can serve as a straightforward methodological tool for decision making in MMR. Nurse researchers can effectively use this decision tree for research and teaching purposes.

Patient or Public Contribution: No direct patient or public contribution.

KEYWORDS
integration procedures, joint displays, mixed methods, nursing research, research methods

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In the last decade, mixed methods research (MMR) has become increasingly popular in the health and social sciences. There has also been an exponential growth in methodological papers about designing, conducting and implementing MMR. Methodologists have proposed various typologies of MMR designs (Bazeley, 2018; Creamer, 2018; Creswell & Plano Clark, 2018), all of which share the essential feature of integrating methods, data and findings, and to a lesser extent, paradigms and philosophical stances. The growing methodological literature also offers a range of integration procedures for ensuring effective integration at the design, methods and analysis levels (Bazeley, 2018; Creamer, 2018; Creswell & Plano Clark, 2018). Integration in MMR can occur at various dimensions such as research question, aims, team, data collection, analysis and interpretation (Creswell & Plano Clark, 2018; Fetters, 2019). To illustrate integration in MMR at the data analysis and interpretation levels, joint displays (i.e. tabular, visual and graphical tools for illustrating the integration of qualitative and quantitative data) are often recommended as the most effective and useful tool (Guetterman et al., 2015; Guetterman et al., 2021). There are a plethora of integration procedures and types of joint displays (Guetterman et al., 2015; Guetterman et al., 2021; McCrudden et al., 2021; Younas, Pedersen, et al., 2020). Therefore, choosing relevant integration procedures can be challenging for many researchers interested in conducting MMR. If inadequate integration procedures are used, it may affect the overall quality of the MMR study as a result of the possibility that MMR research questions will remain unanswered, opportunities for an enhanced understanding of the phenomena being studied will be missed and the potential of gaining depth and texture will be lost, and, in some cases, erroneous conclusions will be generated (Bazeley, 2018; Creswell & Plano Clark, 2018; Fetters et al., 2013).

Despite the increasing guidance on integration procedures, recent reviews of the use of MMR in the health sciences reveal that integration is generally not adequately implemented in MMR. These reviews highlight that researchers often do not effectively use contemporary integration approaches and procedures (Irvine et al., 2020; Younas, Pedersen, et al., 2019), thereby missing out on the unique contribution that MMR can make at the various stages of the study. This failure to integrate could be attributed to the complex and challenging nature of integration in MMR (Onwuegbuzie & Johnson, 2006) and the limited knowledge of researchers about the most pertinent integration procedures (Younas, Pedersen, et al., 2019). In addition, Fetters (2019) noted that often MMR researchers face the challenge of clearly articulating MMR purposes for data collection and analysis during the study planning as this informs future analysis and integration procedures. Given these challenges, this paper offers a straightforward decision tool for selecting relevant integration procedures and pertinent joint displays in accordance with MMR designs.

1 | BACKGROUND

1.1 | Integration procedures in MMR

Integration is defined as the 'purposeful interdependence between different sources, methods and approaches' (Bazeley, 2018, p. 7). It is a strategic and intentional action focused on connecting and linking qualitative and quantitative data and findings to generate inferences (i.e. conclusions drawn from distinct qualitative and quantitative phases) and meta-inferences (i.e. conclusions drawn after the integration of qualitative and quantitative findings; Creswell & Plano Clark, 2018). The deliberate use of linking data collection methods, analytical processes and comparing findings is referred to as the intent of integration (Fetters, 2019). Clarifying the intent integration is crucial to demonstrate that a planned MMR project can result in achieving the research aims and objectives. Additionally, the level of integration (e.g. data collection, analysis, interpretation, reporting) should also be made explicit (Creswell & Plano Clark, 2018).

Three main typologies (Fetters, 2019; Fetters et al., 2013; Pluye et al., 2018) describing integration procedures have been published to clarify the integration intent and levels in MMR and to guide the process of operationalizing integration. These typologies exemplify various integration procedures that can be used at the design, data collection, analysis and interpretation levels in MMR. Fetters et al. (2013) developed one of the most extensively used and well-known typologies of integration procedures, including four techniques, namely, connecting, building, merging and embedding. Connecting entails selecting a sample for the qualitative phase based on the quantitative phase. Building refers to the development of data collection instruments, variables or analysis methods for the quantitative phase based on the qualitative findings. Merging refers to bringing together qualitative and quantitative data after separate analyses. Embedding is a complex technique involving building, merging or connecting. Fetters (2019) updated this typology by renaming integration techniques as integration procedures and proposing eight integration procedures for data collection, two integration procedures for two-phase MMR designs and eight data analysis procedures for a variety of MMR designs.

Pluye et al. (2018) developed an alternative typology of nine integration strategies, classified into three broad integration types: connection (i.e. linking qualitative and quantitative phases and data), comparison (i.e. bringing together qualitative and quantitative data for comparison and merged analysis) and assimilation (i.e. data transformation). Each of these types included three integration strategies, which are an expanded account of the previously described integration procedures of merging, connecting, building and threading. The strategies included in the connection type are (a) connecting the qualitative phase with the data collection and analysis of the quantitative phase, (b) connecting the quantitative phase with the data collection and analysis of the qualitative phase and (c) following a thread procedure to choose themes or variables to explore in the subsequent phase. The strategies included in the comparison type include (a) comparing qualitative and quantitative findings from separate analyses, (b) comparing qualitative and quantitative findings from interdependent analysis and (c) interpreting discordance, consistencies and expansion in qualitative and quantitative findings. The strategies under the assimilation type are (a) transforming qualitative data into quantitative data (quantitizing), (b) transforming quantitative data into qualitative data (qualitizing) and (c) merging both datasets to generate an additional database for analysis. Creamer (2018) proposed three integration strategies, namely blending, converting and

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extreme case sampling procedures for integration at the data collection and analysis levels. Blending is referred to as variable, category or factor created by combining qualitative and quantitative data for testing. Converting pertains to converting qualitative into quantitative data or vice versa. Extreme case sampling entails a purposeful selection of cases that may be outliers for further analysis.

The typologies of integration were reviewed and the types of integration procedures were assessed in terms of their use in MMR. Based on our experiences of designing and conducting mixed methods and writing methodological papers, we included the most commonly used and somewhat well-understood integration procedures. The intention was to focus on those integration procedures that can be applied to core mixed methods designs as well as better illustrated via joint displays. Many integration procedures presented in the typologies had a similar meaning, but different names. For example, the connecting technique as defined by Fetters et al. (2013) and Fetters (2019) is similar to Pluye et al.'s (2018) connection integration type. Pluye's description of various types of connection is similar to threading technique and building integration procedures. Therefore, such procedures were excluded to simplify the idea for researchers using mixed methods. The definitions and examples of select key integration procedures are presented in Table 1.

1.2 | Joint displays in MMR

A joint display is a visual, tabular or graphical tool for the effective reporting of integrated qualitative and quantitative data, findings and meta-inferences in MMR studies (Guetterman et al., 2015; Guetterman et al., 2021; Younas, Pedersen, et al., 2020). Joint displays are recognized as one of the most efficient ways of illustrating the intent of integration and comparing and contrasting different datasets and findings (Bazeley, 2018; Creswell & Plano Clark, 2018; Guetterman et al., 2015). Integration in MMR can be achieved through various approaches such as data transformation, typology development, pattern analysis, comprehensive and intensive case analysis, weaving, contiguous and staged narrative approaches (Bazeley, 2018; Creswell & Plano Clark, 2018; Fetters et al., 2013). Nevertheless, joint displays are often combined with the above approaches at the analysis and interpretation levels when illustrating integration. The potential advantage of joint displays is that these are cognitively understandable for readers for assessing the nature and extent of integration of qualitative and quantitative methods, data and findings (Creswell & Plano Clark, 2018).

Recent methodological reviews have demonstrated that joint displays are frequently used in MMR studies in nursing, psychology, education and social sciences (Guetterman et al., 2021; McCrudden et al., 2021; Younas, Pedersen, et al., 2020) and are particularly valuable because they enable researchers to exemplify the what, how and why of integration through tabular, visual and integrated means (Fetters, 2019). These reviews have also proposed a range of joint displays for use in MMR studies. In their seminal paper, Guetterman et al. (2015) proposed a typology of joint displays in accordance with the purpose and design of the MMR and various integration procedures. This typology includes statistics-by-themes, participant selection display, instrument development display, qualitative data experiment display, theoretical lens display, cross-case comparison display, side-by-side display, interview question display and generalizing themes display. Over years, this typology has been revised by various authors. Younas, Pedersen, et al. (2020) reviewed 17 MMR nursing studies that used joint display for integration and identified an additional type of display called the graphical theme display. In a methodology discussion paper that reviewed joint displays in the field of psychology, McCrudden et al. (2021) identified additional innovative joint displays such as interview prompts displays, integrated result matrix, quantitative results matrix and integrated visual displays. Figure 1 presents an example of a statistics-theme joint display.

2 | AIMS

To propose a decision tree for identifying relevant integration procedures and joint displays for achieving integration in MMR studies.

3 | DATA SOURCES

This discussion paper is based on our experiences designing, conducting and teaching MMR at graduate-level courses and training workshops in Pakistan and Italy. We identified the key methodological literature such as MMR textbooks, methodology discussion papers and reviews and MMR studies published in the last 10 years (2012–2022) across the social, health, behavioural and educational sciences. The published literature was searched in key methodological journals (e.g. *Journal of Mixed Methods Research*, *International Journal of Multiple Research Approaches*, *Quality and Quantity*, *Methods in Psychology*) and health sciences and nursing journals (e.g. *Journal of Advanced Nursing*, *Annals of Family Medicine*, *Western Journal of Nursing Research*) that publish methodological and empirical mixed methods studies. The search terms used to identify relevant literature were as follows: "mixed methods", "multiple methods", "multilevel", "integration", "integration procedures", "integration techniques", "data integration" and "mixed methods research". No specific databases were searched because the methodological literature on mixed methods is mostly published in specific methods journals. The researchers were already aware of the key methods journals based on their experience of using and teaching MMR. Two of the researchers had also conducted several prevalence reviews mapping the nature and quality of MMR in nursing, with various integration procedures and joint displays that aided us in developing the decision tree.

4 | DISCUSSION

4.1 | Decision tree

A decision tree is useful for making sequential decisions under uncertain research conditions. In particular, our proposed decision tree can be extremely useful in providing a comprehensive overview of the various

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TABLE 1 Integration techniques with examples

Integration technique	Description	Example
Building	Using one form of data to inform the data collection instrument and/or data analysis approach for the subsequent phase (Fetters et al., 2013; Fetters, 2019; Creamer, 2018)	Younas, Rasheed, et al. (2020) used a six-step building approach that entailed qualitative analysis followed by the selection of key themes and subthemes, linking them to the participants' quotes and then converting these quotes into pertinent items of a questionnaire examining nurse educators' challenges of teaching undergraduate nursing students
Generating hypothesis	Using qualitative results and findings to generate hypotheses for testing in the subsequent quantitative phase (Fetters, 2019)	Polachek and Wallace (2018) aimed to examine the interactions contributing to compassion satisfaction and compassionate fatigue in animal care health care providers. They used the interview data from 20 providers to generate four hypotheses about successful and stressful interactions and their impact on compassion satisfaction and fatigue. These hypotheses were then tested in the subsequent quantitative phase
Exploring	Using qualitative data and analyses for initial exploration to better understand relevant concepts for the subsequent quantitative phase (Fetters, 2019).	Jokiniemi et al. (2018) aimed to develop competency criteria for clinical nurse specialists in Finland. They used findings from the qualitative phase to develop preliminary competency criteria via open-ended questions in a Delphi survey. The initial criteria included 75 competencies, which were refined and categorized under four domains corresponding to the patient (18 criteria), nursing (22 criteria), organization (16 criteria) and scholarship (19 criteria) roles. These criteria were cross-matched with the clinical nurse specialist competency criteria of the US and Canada. At the end of this phase, a 61-item set of competency criteria was retained. Finally, following the qualitative survey with clinical nurse specialists, the final 50-item competency criteria were developed
Threading	Conducting a preliminary analysis of qualitative and quantitative data for generating significant themes and exploratory questions about a phenomenon and then selecting one key theme or questions from one dataset and following it across and between all other components (Moran-Ellis et al., 2006; Pluye et al., 2018).	King et al. (2014) implemented data transformation using threading and matrix development. First, they analysed the qualitative and quantitative data separately to generate overarching themes and questions, which they then incorporated into a secondary analysis to investigate data interaction. They examined overarching themes through individual case analyses and vice versa, and then generated an integrated interpretation of the data. Findings were presented as integrated themes
Comparing	Collecting qualitative and quantitative data about a certain phenomenon or a construct to examine how these two datasets relate to each other (Fetters, 2019; Pluye et al., 2018).	Durante et al. (2022) used the comparing technique to examine the relationship between quantitative data about resilience levels and factors affecting resilience and qualitative data on caregivers' perceived factors affecting their resilience. They performed separate qualitative and quantitative analyses and then compared the results at the factor level. The comparison revealed that caregiver burden had no significant effect on resilience, while caregiver depression was a significant factor. The comparison also generated two resilience-promoting factors from the qualitative data, which were not identified in the quantitative data
Initiating	Analysing qualitative or quantitative data to discover contradictions by reorganizing questions or findings from one method with the other method (Fetters, 2019).	Rasheed et al. (2021) conducted a mixed methods study to examine the self-awareness of nurses in practice. At the end of the study, they identified that nurses' self-awareness levels may vary according to their roles. Therefore, to address this additional finding, they generated a new qualitative question to explore the role, nature and application of self-awareness of nurses in managerial positions
Constructing a case	Utilizing qualitative and quantitative data collection and analysis to generate a comprehensive understanding of a case (i.e. a population, a group, an individual or an organization) (Fetters, 2019).	van Zelm et al. (2021) aimed to evaluate factors associated with the successful implementation of a care pathway for patients who underwent surgery for colorectal cancer. First, they conducted a separate analysis of qualitative and quantitative data. The quantitative data analysis resulted in the identification of two cases (highest and lowest performing hospitals). The qualitative analysis informed generating case descriptions for each hospital which entailed a brief explanation of the quantitative findings and the experiences of professionals involved, with a focus on the four core constructs (i.e. capability, capacity, potential and contribution) of the normalization process theory

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TABLE 1 (Continued)

Integration technique	Description	Example
Expanding	Using qualitative and quantitative data collection methods to develop a broad but overlapping viewpoint about a phenomenon (Fetters, 2019).	Gellerstedt et al. (2019) conducted a convergent mixed methods study to explore and comprehensively describe the perceptions of nursing students' perceptions of their preparedness to address and support patients' sleep during hospitalization and to apply sleep-promoting interventions in a clinical context. However, they also had an expanded purpose to explore from the perspective of students whether, and how, the topic of sleep is explicitly incorporated in nursing education programmes
Diffracting	Examining different aspects of multifaceted phenomena by using both qualitative and quantitative data collection (Fetters, 2019).	Ertesvåg et al. (2021) illustrated the use of diffraction by examining four distinct research questions in mixed methods study of classroom interaction for the purpose of enhancing student learning. The study aimed to improve teachers' classroom interaction skills. Multiple data collection, analysis and integration procedures were used to understand how teachers improve their instructional skills, how they implement and enact instructional skills in the classroom, how they understand classroom interaction and how they perceive collaborative activities for improving classroom interaction skills. They conducted separate analyses using growth mixture modelling and content analysis, and then implemented two-level data transformation by qualitizing survey data to identify profiles of teachers' perceptions and integrating the transformed data into other qualitative data from the interviews and observations that had not been transformed. They noted that using multiple integration strategies and examining distinct questions using unique methods resulted in the generation of new knowledge and understanding that went beyond the potential of different data sources to generate a comprehensive understanding of class interaction
Enhancing	Using qualitative and quantitative analysis and generated information for developing a more meaningful understanding of a phenomenon (Fetters, 2019)	Rheault et al. (2021) developed an expanded understanding of the chronic disease education and self-management needs and the health literacy abilities of Australia's First Nations adults. After performing separate qualitative and quantitative analyses, they applied a bidirectional simultaneous approach to examine the overlap of qualitative and quantitative results and better understand the relationship between health literacy and self-management education and needs, as well as their various dimensions
Explaining	Using qualitative findings to explain new and or unique findings obtained in a quantitative phase (Fetters, 2019).	Hayes et al. (2015) explored factors affecting satisfaction with the work environment, job satisfaction, job stress and burnout in haemodialysis nurses. They surveyed nurses using multiple validated tools to measure the constructs and then further explained the key quantitative results via qualitative interviews. For example, some of the key results from the quantitative survey included flexible management ($M = 3.74$, SD = 0.75) and feeling valued ($M = 3.65$, SD = 0.68) as highly ranked contributing factors to the satisfaction with work environment. Interview questions were asked to a select group of nurses to elicit additional information about their the perceptions of these factors and to ascertain the reasons for their high scores
Corroborating	Finding information from one data form to support the other (Fetters, 2019; Pluye et al., 2018).	Hammerschmidt and Manser (2019) determined the individual and organizational factors affecting hand hygiene, as well as the role of nursing managers in role modelling. They completed separate analyses of quantitative survey data from nurses and interview data from nurse managers. They triangulated/corroborated the results by examining the relationships, variations and connections between the mixed data and the theoretical concept that informed the study. They found shared, complementary and divergent results concerning perceptions of hand hygiene, training and modelling behaviours

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TABLE 1 (Continued)

Integration technique	Description	Example
Connecting	Using results from one phase to inform the sampling procedures for the second phase (Fetters et al., 2013; Pluye et al., 2018).	Draucker et al. (2020) used a five-step approach connecting technique that involved selecting variables to create subgroups, determining high and low cut-off scores on the selected variables, identifying favourable and unfavourable composites, creating subgroups profiles that converged with or diverged from the model and recruiting participants for the subgroups
Merging	Combining qualitative and quantitative data at various levels to examine differences and generate a meaningful understanding of data, results or interpretations (similar to comparing or enhancing) (Fetters et al., 2013; Fetters, 2019; Pluye et al., 2018).	Younas and Sundus (2022) used the merging technique in the form of tripartite analysis to generate a more meaningful understanding of nursing students' views of compassion. At the first level, they merged qualitative and quantitative results of students who provided both qualitative and quantitative data; at the second level, the results of the whole qualitative and quantitative sample were integrated, and finally, the results from level one and level two analyses were compared and merged to develop a more nuanced understanding of nursing students' evolved views about compassionate nursing care

TABLE 6 Joint display depicting factors affecting caregiver resilience

Quantitative	Qualitative	Mixed meta-inferences
HADS depression score was associated with resilience ($B = -2688$, $p < .001$), with the model explaining 22% of the variance ($R^2 = 0.22$, $F(1,194) = 55,528$, $p < .001$)	**Psychological Outlook:** Caregivers experienced hopelessness and powerlessness concerning challenging and uncertain situations and inadequate support from their family members who need care. These negative emotions affected their attitudes towards caregiving and life. "Anxiety and depression, I say it is not, because I know what a depression is. But yes sadness... Sadness, there are times when I am really sad. As they say, "Are you angry? No, I'm sad." And something that I haven't cried for a thousand years, I cry. Quite a lot, but it is more the impotence of not being able to give, perhaps, what they want, more than if... Because they do not do anything, because I cry... But myself... And stress. More than stress is that it is anxiety. I think it's more anxiety than stress." (Spanish daughter, 52 years old) **Affective State:** Caregiving was challenging and uncertain. It affected emotional well-being of caregivers, which in turn resulted in varying emotional states. "There is so much that you have no influence on, do you? What just happens and that is often uncertain. (...) And I have to pick up myself every time, anyway. And that he is falling, so unstable... that is very uncertain and very nasty." (Dutch wife 80 years old)	**Confirmed.** The caregivers hopelessness, pessimism, powerlessness and feelings of being unsupported and discouraged affected their psychological outlook. The caregivers experienced anxiety, frustration and pressures which lead to continuous fluctuations in affective state. These two factors resulted in depressive feelings among caregivers.
Caregiver burden was not associated with caregivers' resilience	**Physical Weariness.** Physical struggles to manage personal chronic health issues, while striving to provide effective care to their loved ones lead to fatigue and burnout. "I have fibromyalgia and yes sometimes I get crazy." (Dutch wife 78 years old)	**Discordant.** Physical fatigue and burnout affected caregiver burden. Physical weariness could be considered relevant to caregiver burden. The quantitative results did not indicate that burden predicted resilience. However, qualitative data suggested that caregiver burden is a hindering factor to greater resilience.

FIGURE 1 Example of a statistics theme joint display. Adapted with permission for Wiley. Originally published in Durante et al. (2022) and copyrights owned by *Journal of Advanced Nursing*, Wiley

types of integration methods and joint displays suggested in the literature and showing their differences; demonstrating the relationship between MMR designs, integration methods and joint displays and assisting researchers in making the most appropriate integration method decision for each specific research situation. Our decision tree for MMR includes three main components. The first component is the typology of core MMR designs and their key purposes. In total, 14 key purposes are outlined and linked to the second (i.e. integration procedures) and third components (i.e. joint displays) of the decision tree. The decision tree is illustrated in Figure 2 and the components are described as follows.

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4.2 | Component one: MMR designs

There are several typologies of MMR: (a) parallel, sequential, conversion, multilevel and fully integrated designs (Tashakkori et al., 2021); (b) simultaneous, sequential, complex, qualitatively driven, quantitatively driven and multi-method designs (Morse & Niehaus, 2009) and (c) exploratory sequential, explanatory sequential and convergent designs (Creswell & Plano Clark, 2018). Irrespective of the typology, MMR involves the use of qualitative and quantitative methods and philosophies in a logical and integrated manner, the collection and analysis of qualitative and quantitative data, and the integration of these data to yield meaningful inferences and meta-inferences (Creswell & Plano Clark, 2018). For this paper, we used the most recent typology of MMR designs by Creswell and Plano Clark (2018). We chose this typology because for several reasons. First, the unique feature of this typology is distinguishing core mixed methods designs, their variants and complex mixed methods designs. Second, Creswell and Plano Clark (2018) explicitly discussed and promoted the use of integration procedures and joint displays as ways of integration in their MMR typology.

The detailed description of each design and the variants is as follows.

The convergent design also called parallel or concurrent, enables researchers to bring together qualitative and quantitative data to develop a comprehensive understanding of a phenomenon or to validate the results of one data set over those of the other. This design includes four variants: (a) parallel database variant, which involves parallel data collection and independent qualitative and quantitative data analysis, which are then merged during interpretation to examine the facets of the same phenomenon within a single inquiry; (b) data transformation variant, which involves parallel data collection but data merging occurs via the transformation of qualitative data into new quantitative variables (i.e. data can be transformed via case analyses, matrices, theory-based methods, narrative summaries, factor analyses); (c) questionnaire variant, which involves using a questionnaire with both open and close-ended questions but does not include a complete qualitative data collection and (d) fully integrated variant, which entails the collection of qualitative and quantitative data at multiple points through the revision of the questions that are asked of the participants. Unlike, the parallel database variant, in a fully integrated variant, the qualitative and quantitative strands are not kept separate during implementation before merging.

Explanatory sequential design, is a two-phase design that begins with quantitative data collection followed by a qualitative phase that explains or expands on the results of the quantitative phase. This design includes two variants: (a) follow-up explanations variant, in which the quantitative phase is emphasized and the qualitative phase is used to explain the results of the quantitative phase and (b) case-selection variant, in which the qualitative phase is prioritized with the intend to examine the studied

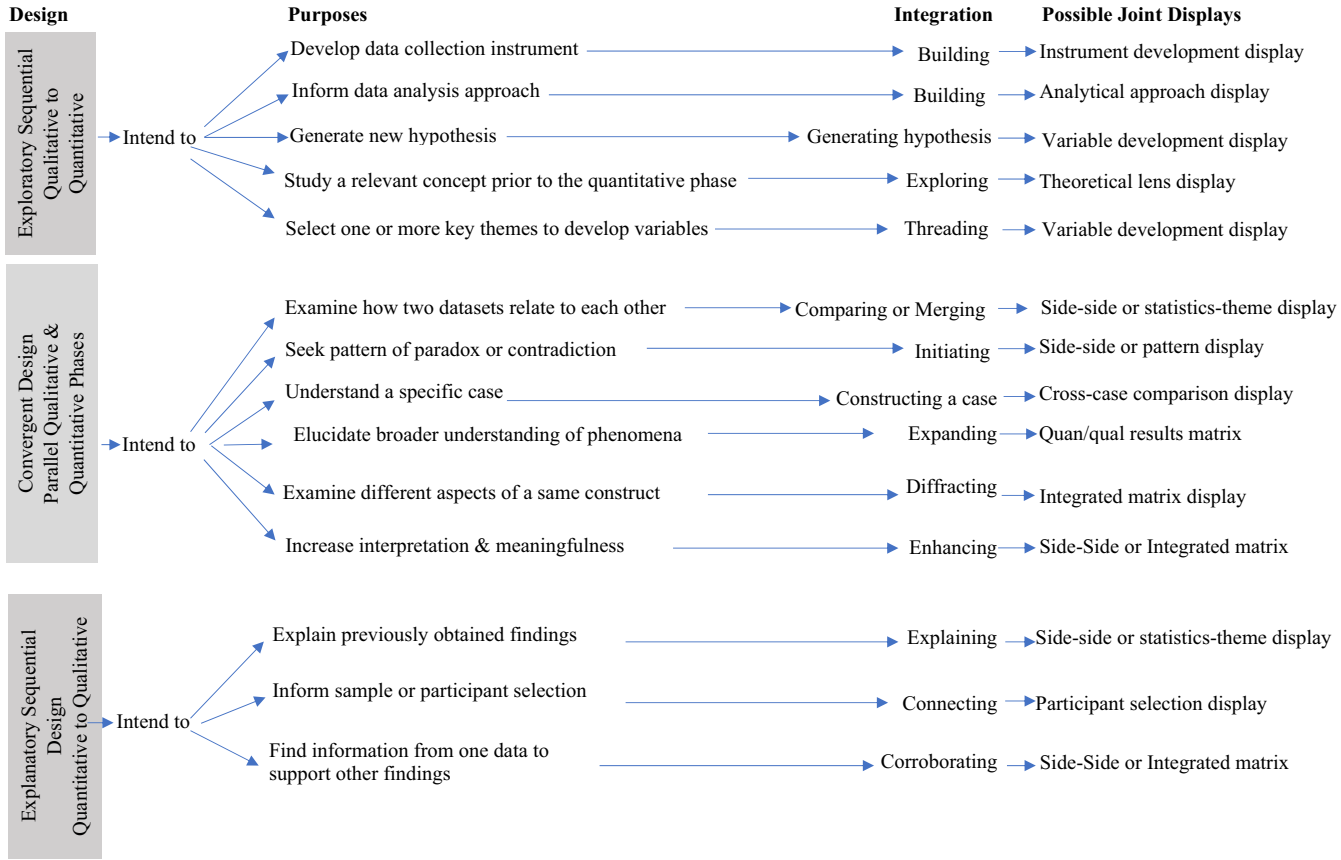

FIGURE 2 Decision tree: Design, purposes, integration technique and possible joint displays

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phenomenon qualitatively. Therefore, the quantitative phase is used to identify and select the best participants (e.g. purposive sample) for the qualitative phase.

The exploratory sequential design is a three-phase design involving qualitative data collection followed by quantitative data collection. This design has four variants: (a) new variable development variant, during which the researcher identifies a conceptual framework, or a new concept, leading to the development of a new variable for use in the questionnaire or any other component of the quantitative phase; (b) instrument development variable, which is used for the development of a context-specific data collection instrument; (c) intervention development variant, which is used to develop a new intervention or adapt an existing intervention for testing and usefulness in a different context and (d) digital tool development variant, which can be used for evaluation in the subsequent quantitative phase.

4.3 | Component two: Integration procedures

We reviewed the definitions and applications of integration procedures listed in the three typologies (Creamer, 2018; Fetters, 2019; Pluye et al., 2018). The degree of similarity between the techniques was determined by their intended purpose in the MMR design. While most of these techniques and procedures serve the same purpose, they are assigned different names in these typologies. As a result, we identified 14 relevant integration procedures that can be implemented across convergent, exploratory sequential and explanatory sequential designs. Examples of how these 14 integration procedures were used in published MMR studies in nursing and health sciences, as well as other fields, were identified. It is critical to emphasize that multiple integration procedures can be used within a single study to integrate at various dimensions. A detailed overview of these 14 integration procedures, along with their definitions and examples, is presented in Table 1.

4.4 | Component two: Joint displays

The nature and type of joint display used to represent integration are contingent upon the MMR study design, the intent of the integration and the integration procedure (Guetterman et al., 2015, 2021; Younas, Pedersen, et al., 2020). Joint displays are effective means of developing linkages between integration procedures and mixed methods designs and exemplify integrative thinking (Bazeley, 2018; Guetterman et al., 2021; Younas, Pedersen, et al., 2020). For example, in exploratory sequential two types of joint displays are recommended. One joint display to illustrate the building procedure and the second display illustrate the merging procedure (Creswell & Plano Clark, 2018). In accordance with the 14 integration procedures in the decision tree, we selected 16 displays from the published typologies of joint displays. Each of the displays chosen corresponded to a certain integration procedure relevant to the MMR design. The chosen displays included visual, tabular and statistical themes and matrix types. The key features of these displays, their characteristics and examples from published studies with visuals are presented in Table 2.

TABLE 2 Templates for joint displays

Joint display and features	Potential templates and examples of joint displays from published literature
Instrument development display • Include qualitative data/themes/codes that have been converted into instrument items • Include newly generated items/domains or subscales of the newly developed instrument	Younas, Zeb, et al. (2019) conducted an exploratory sequential mixed methods study to explore nurse educators' challenges of teaching undergraduate nursing students. They developed a joint display to illustrate how the themes and categories from the qualitative phase were converted into questionnaire items developed using the building integration procedure. In the first column, they presented the qualitative themes and categories as well as the number of quantitative items developed for each category, while in the second column, they reported the items connected to each theme and category

Table 2
Joint display mapping qualitative themes and categories to the developed questionnaire (integration of phase I & II).

Qualitative theme and categories	Quantitative items
Theme I: personal challenges (8 items)	
Workload and time management (4 items)	The educator does not have enough time to discuss students' issues, the educator is overburdened with workload, the educator finds it difficult to grade group assignments, and educators are required to perform clerical tasks.
Educator- student relationship (1 item)	The overfriendliness of educator with students prevents effective teaching
Personal motivation and learning (2 Items)	The educator lacks personal motivation to effectively teach students & Nurse educators do not engage in their own continuous professional development and education
Teaching-culture-conflict (1 item)	The educator faces cultural challenges while teaching content and skills related to human sexuality
Theme II: institutional challenges (14 items)	
Lack of autonomous decision making (3 items)	The educator has no authority to change institutional teaching and learning practices, the educator has no role in making policies for nursing education, & the educator lacks independent decision making about student teaching.
Roles and responsibilities conflicts (3 items)	The roles and responsibilities of educator are poorly defined, there is a difference between an educator's personal teaching philosophy and the expectations of the management, & educators are required to teach subject matter that does not match their personal interest.

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TABLE 2 (Continued)

Joint display and features	Potential templates and examples of joint displays from published literature
Analytical approach display • Include qualitative data/themes/codes and their frequencies, volume or other relevant parameters that informed the analysis approach or method • Include the key components of the data analysis approach for the quantitative phase	Younas et al. (2022) based on their exploratory sequential mixed methods study of nurse educators developed a data analysis strategy (sociocultural exploration strategy) to identify and address discordant findings in their mixed methods analysis. They developed this analytical strategy after applying the merging integration procedure by utilizing both qualitative and quantitative data. To illustrate their analysis strategy they developed a joint display outlining qualitative and quantitative data and the resulting outcome from the use of their sociocultural exploration strategy

Table 2. Sociocultural exploration strategy to address discordant findings.

Steps	Supporting data		
Developing a qual-code—Quan mean matrix of the overarching theme	Qualitative theme and number of codes	Number of items	Quantitative mean
	Personal Challenges (n = 59)	8	3.08
	Institutional Challenges (n = 40)	3	3.13
	Challenges in Clinical Teaching (n = 72)	9	3.58
	Classroom Environment Challenges (n=39)	5	3.12
	Student Related Challenges (n=84)	11	3.29
	Ministerial Challenges (n=53)	8	3.78
	Educational Research Challenges (n=29)	3	3.65
	Likert scale for quantitative mean: 1= To no extent, 2= To a little extent, 3= To some extent, 4= To a moderate extent, 5= To a great extent		
Listing number of discordant findings under each theme	Qualitative Theme	Number of discordant findings	Items identified as discordant finding
	Personal Challenges	1	The educator lacks personal motivation to teach students (Mean = 2.79, Qualitative codes = 09)
	Institutional Challenges	1	The institution provides no guidance on students' assessment and evaluation (Mean= 2.96, Qualitative codes=10)
	Challenges in Clinical Teaching	0	
	Classroom Environment Challenges	1	There is a lack of multimedia resources (Mean= 2.78, Qualitative codes=06)
	Student Related Challenges	1	Educators face difficulty in teaching students of opposite gender due to cultural factors (Mean= 2.83, Qualitative codes=05)
	Ministerial Challenges	0	
	Educational Research Challenges	0	
Creating sociocultural profile of each discordant finding	Item	Sociocultural profile based on the region and educational culture	
	The educator lacks personal motivation to teach students	Two of the 12 educators discussed this in their qualitative interviews. These two educators were from Swat and Peshawar region where the educational culture and environment is different from other more developed cities. Compared to Lahore, Islamabad, and Rawalpindi the nursing institutions in these two cities are in the recent stages of development. The educators discussed that they had concerns with the approach of the nursing administration concerning the use and implementation of new strategies. Therefore, there are two possibilities. First, these two educators projected this experience and judged other educators as having limited motivation to teach students through the use of creative teaching and learning strategies. Second, the educators working at the institutions may be less motivated. However, the first explanation is the most likely to be true because the quantitative data from these cities indicated that educators' lack of motivation was not a significant challenge	
	The institution provides no guidance on students' assessment and evaluation	Of the twelve targeted nursing institutions, five institutions were into their third or fourth year of teaching. These institutions were located in Lahore, Peshawar, and Swat. The educational social and cultural factors that could have resulted in this discordant finding are: the curricula being still in development, the conflicts of nurse educators and the non-nursing management, and the limited teaching experience of the educators. These factors were noted in the qualitative interviews of educators from these institutions and the demographic data also indicated that most of the employed educators at these institutions had a Post RN or BSN degree in nursing. Therefore, the guidance could have been available, but not adequately transferred to the educators due to educator-managerial conflicts during the early days of curricula development and implementation.	
	There is a lack of multimedia resources	This finding emerged from the qualitative interviews of educators who worked at the nursing institutions that are newly developed and are in semi-urban cities (i.e., Swat and Peshawar). The educators were working with limited resources and they also had challenges in bringing forth their issues to somewhat non-supportive nursing administration. The qualitative findings also revealed that the semi-urban nature of the cities, a large student educator ratio, and limited resources prompted educators to rely on traditional methods of teaching and learning. When these educators requested for advanced multimedia resources, the management were not supportive of spending additional finances on such resources.	
	Educators face difficulty in teaching students of opposite gender due to cultural factors	This finding mainly emerged from the cities (Swat and Peshawar) with more conservative education and culture. It was conservative in two ways. There is limited emphasis on co-education in colleges and universities as male and female are often expected to study in separate institutions. Second, the social norms restrict interaction of men and women and greater interaction is often perceived in negative ways. Therefore, male educators and male nursing students often practice great caution when talking to and interacting with female colleagues. It is often difficult for male educators to engage in more open discussion with the female students. These educators believe if the interactions are more friendly, others may designate it as a scandal. On the other hand, in other cities co-education is quite common and the culture is not as conservative.	
Labeling discordant findings as trivial or significant	Item	Final label and decision	
	The educator lacks personal motivation to teach students	Trivial	Further exploration needed in the regional context
	The institution provides no guidance on students' assessment and evaluation	Trivial	Further exploration needed in the regional context
	There is a lack of multimedia resources	Trivial	Further exploration needed in the regional context
	Educators face difficulty in teaching students of opposite gender due to cultural factors	Trivial	Further exploration needed in the regional context

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TABLE 2 (Continued)

Joint display and features	Potential templates and examples of joint displays from published literature
Variable development display • Include qualitative data/ themes/codes, and their description • Include generated variables and items from the themes/sub-themes or codes	Crooks et al. (2018) developed a model to identify rural Canadian communities most in need of and ready for palliative care service enhancement and apply the model to improve palliative care services. Their first mixed methods siting model was based on a pilot quantitative study in one Canadian province. Based on interviews with 31 stakeholders, they recognized the need to add additional concepts and related variables to the model. Therefore, they revised their initial model, and generated variables, and indicators for each of the variables using the building integration procedure. They did not present a joint display, but we used their study findings to create a visual variable development joint display illustrated as follows

Step 1: Development of mixed methods siting model: A quantitative pilot study in a single setting (i.e., one Canadian province) led to the development of a siting model **(Quantitative)**

Step 2: Identifying the need to tailor the siting model to increase its applicability to wider rural Canada: Interviews with 31 key informants revealed that an important additional factor needed to be added to the siting model: ***Community readiness*** **(Qualitative)**

Step3: Qualitative interviews with key informants to refine the siting model and generation of a new variable for the siting model (Qualitative)

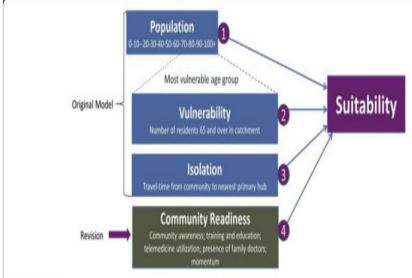

Fig. 2 Revised Siting Model Based on Pilot Study (adapted from [41])

Step 4: Development of variables (i.e., dimensions) and indicators for the new variable Community Readiness (Qualitative)

Table 2 Revised Community Readiness Variables and Indicators

Variable	Meaning	Indicator
Community Awareness	Showing evidence that palliative care is a priority issue. Does palliative care have visibility or a 'profile' in the community?	Subjective Indicator: presence of locally-relevant factors that indicate community awareness can result in 'Yes' for this variable (factors may include: presence of local hospice society; educational tools promoting awareness; presence of community volunteers; stakeholder acknowledgement).
Training and Education	Strengthening palliative care in rural communities requires providing local education opportunities. Is there a site to host and possibly coordinate such initiatives?	Binary Indicator (Y/N): Is there a local college or university campus?
Telemedicine utilization	Telemedicine can increase capacity for providing palliative care in smaller sites. Is the community ready to link to larger centres via telemedicine in order to facilitate information sharing?	Binary Indicator (Y/N): Is there regular use of telemedicine at the local hospital?
Presence of family doctors	Family doctors play a vital role in providing palliative care in rural areas. Are there adequate family medicine resources locally to enhance palliative care provision?	Binary Indicator (Y/N): Do family doctors practicing locally have an adequate family physician to population ratio?
Momentum	Enhancing palliative care is not an end point, but rather the start of accomplishing larger goals. Has there been demonstration by the community of the desire to increase palliative care capacity?	Subjective Indicator: presence of locally-relevant factors that indicate momentum can result in 'Yes' for this variable (factors may include: proposal for local hospice; new employment or volunteer positions; new spaces or places being created; projects and plans implemented at larger scales).

Supporting Qualitative Quotes

Participants described the need of education such as "*a training session for the nursing staff working on our palliative care beds, so they've actually had some education just recently*" (Crooks et al. 2018, p.6)

Participant quote about community awareness "*There is the awareness and there are people coming together to try to provide appropriate palliative care…so the desire and the will is there and people realize that it's something that we have to continue to look at and develop and grow, to meet the needs of the community*" (Crooks et al. 2018, p. 7)

Theoretical lens
- Include theoretical constructs, relational statements or theoretical domains
- Include qualitative data/ themes/codes, along with their description and inferences
- Include participant quotes
- Include quantitative findings and inferences

van Zelm et al. (2021) conducted a mixed methods case study to evaluate the implementation of a care pathway for colorectal cancer surgery in 10 hospitals. They used the normalization process theory as the guiding framework and conducted pre-post measurements and post-implementation interviews for process evaluation. Based on the quantitative results using the connecting integration procedure, they identified five highest and five lowest-performing hospitals. Three participants were interviewed from each hospital, and data from the interviews was analysed using the normalization process theory's four concepts (i.e. capability, capacity, potential and contribution). They presented their quantitative and qualitative results under each concept in a joint display. The joint displays were based on the theoretical concepts, hence can be labelled as theoretical lens displays

Table 6 Joint display potential

Potential: Social-cognitive resources available to agents (Individual intentions & Collective commitment)					
	AR (IR)	**SrA**	**↑↓**	**LOS (ΔLOS)**	**Qualitative data**
Hospital 1	75% (10%)	88%	↑17 ↓5	(6.0d) (−3.1d)	• Willingness to change was present, team wanted to improve further • Quality improvement is considered important within hospital • CP development is team effort, with collective goals • CP development aligned with hospital strategy, higher management decided to join the project
Hospital 2	65% (22%)	60%	↑18 ↓3	8.2d (− 4.2d)	• Improvement team was motivated • Motivation hampered by conflicting priorities • Identifiable collective reason to start project • CP development aligned with hospital strategy, higher management decided to join the project
Hospital 8	47% (−13%)	71%	↑6 ↓9	10.3d (−4.4d)	• Little motivation and collective commitment • Certification, external pressure as leverage for CP development • Conflict of views on quality: administrative vs clinical approach • CP development not aligned with hospital strategy, middle management decided to join the project
Hospital 9	54% (−3%)	72%	↑13 ↓6	10.2d (2.1d)	• Lacking shared goals and commitment • External pressure provides leverage for CP development • Management not involved, quality improvement as 'part of the job' • CP development not aligned with hospital strategy, team decided to join the project
Hospital 10	64% (−5%)	64%	↑7 ↓8	18.8d (1.8d)	• Feedback of the pre-test data acted as trigger, team intrinsically motivated • Quality improvement perceived as important part of the job, project as opportunity to update local protocols, benchmark and learn • CP development is a team effort, with shared ambitions, but more so on the ward where medical champion worked • Little to no support by management, and different views on quality between management and clinicians • CP development is not aligned with hospital strategy, middle management decided to join the project

AR Adherence rate post-test, *IR* Improvement rate, *SrA* Self-rated adherence, ↑↓ number of interventions on which adherence went up or down, *LOS* length of stay post-test, *ΔLOS* change in mean LOS (days)

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TABLE 2 (Continued)

Joint display and features	Potential templates and examples of joint displays from published literature
Side-by-side display • Include qualitative data/ themes/codes along with their description and inferences • Include participant quotes • Include quantitative findings and inferences • Include mixed methods meta-inferences	Sundus et al. (2020) conducted a mixed methods study to understand nursing students' perspectives and meanings of compassion and compassionate nursing care. Using a convergent design, they carried out an exploratory survey determining various meanings of compassion and compassionate nursing care and semi-structured interviews to explore more in-depth accounts about compassion. They developed a side-by-side display using the merging integration procedure to illustrate overarching themes, quantitative results and qualitative themes with quotes. In the last column of the table, the authors presented the mixed methods meta-inferences drawn from linking the quantitative and qualitative data for each theme

Table 3
Joint display of key quantitative and qualitative results.

Overarching themes	Quantitative results	Qualitative results	Mixed methods meta-inferences
Meaning of compassion and compassionate care	In total, 64.1–88% of students responded "*Yes*" to meanings of compassion and compassionate care found in nursing literature, while 12–35.9% responded "*No*".	The nursing students considered compassionate care as the eagerness to learn about and meet patient needs, providing ethical and safe care, intentional effort to relieve patient distress, caring for the whole being, being sympathetic towards patients, and recognizing and feeling for patient suffering. Supporting quote "Compassionate care means providing care to your patients with sincerity, rather than just completing your nursing responsibility. It means making a personal choice to complete a task in a sincere way" (male, 24 years).	Discordant. The survey results indicated that students had a clear understanding of compassion and what compassionate care entails. However, during the interviews the students used all sorts of terms to describe compassion and compassionate care. This shows that students' understandings of compassion and compassionate care are not consistent with the meanings outlined in nursing literature.

Joint display and features	Potential templates and examples of joint displays from published literature
Statistics-theme display • Include qualitative data/ themes/codes along with their description and inferences • Include participant quotes • Include quantitative statistical data, findings and inferences • Include mixed methods meta-inferences	Younas, Zeb, et al. (2019), in an exploratory sequential mixed methods study of challenges of nurse educators, developed a second joint display to compare the qualitative results from phase 1 with the quantitative results from phase 3. At this stage of analysis, they used merging integration procedure. The authors developed a statistics-theme display with bar charts illustrating quantitative results, themes with quotes and mixed methods inferences

Table 4
Joint display of phase I & phase III results.

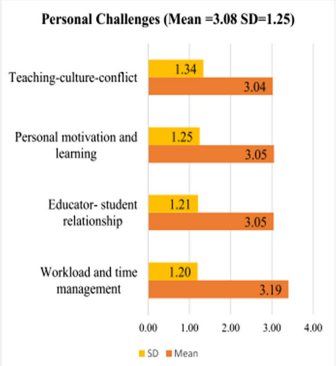
Qualitative themes & categories and quantitative data	Qualitative quotes	Mixed methods inferences
	One of the educators talked about time constraint and workload. "Time management is a challenge. If there is unequal distribution of credit hours and one educator is overburdened, then the delivery of teaching content would be difficult. If I would be required to deliver 5 to 6 lecturers a day either in a classroom or clinical settings, it would be really difficult for me."	Confirmed Workload and time management were the most reported personal challenges. Educators indicated that they are overburdened because of a large number of students, unequal distribution of teaching and clinical hours, and assignment of the duties which are not included in the job description. Some educators indicated that they are required to deliver 5–6 lectures a day and additionally they often perform clerical tasks.

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TABLE 2 (Continued)

Joint display and features	Potential templates and examples of joint displays from published literature
Cross-case comparison display • Include total cases subjected to cross-case analysis • Include qualitative data/ themes/codes along with their description and inferences • Include quantitative statistical data, findings and inferences • Include mixed methods meta-inferences	Younas and Sundus (2022) developed a Tripartite Analysis (TriPA) approach for mixed methods analysis using the merging and linking integration procedures based on their study about nursing students' perspectives of compassion and compassionate nursing care. In the first step of TriPA, they generated joint displays for eightindividual cases and compared the qualitative and quantitative results at the case level. They presented an exemplar joint display for one case but noted that several similar joint displays were created to compare the data across eight cases. The exemplar case level joint display is presented as follows

TABLE 1. Example of Case-by-Case Analysis

23 Years old 4th Year Female Student						
Domain	**Survey Items**	**Response**		**Qualitative Quotes**	**Inferences**	**Additional Findings**
		Yes	**No**			
Meaning of Compassion*	Sharing patients' suffering			"Compassion means showing sympathy with the patient, giving respect, and helping patients in their suffering"	Expanded because compassion was thought to be sympathetic to patients	"Compassionate care is also linked to evidence based practice" "Compassionate care is medical and emotional care for patients with cancer in order to make their lives and end of life days more comfortable".
	Understanding and sharing patients' suffering					
	Consciously helping patients to achieve a sense of well-being			"The patient was in pain, and she was calling the nurse over and over again, but the assigned nurse kept ignoring her. I helped the patient, comforted her, and advocated for her so that she could get pain killers"	Confirmed	
	Being in unity with patients in their sadness and suffering					
Meaning of Compassionate Care*	Consciously trying to understand patients, their needs, and their suffering			"Compassionate care means providing empathetic care. It means care for patients as if you are caring for your relative or family member"	Confirmed	
	Spending time with the patients in their sadness and suffering				Confirmed	
	Becoming sensitive to patients' suffering, situations, and feelings				Confirmed	
	Being non-judgmental and open to acknowledging patients' suffering				Discordant	
	Taking actions to alleviate patients' suffering				Discordant	
	Respecting patients' autonomy and their values for alleviating their suffering					

Qualitative/quantitative results matrix • Include the overall qualitative themes or inferences • Include quantitative overall scores pertinent to the qualitative themes • Include mixed methods meta-inferences	Poudel et al. (2018) explored the reasons for the migration intention of students enrolled in pre-registration nursing programmes. The authors employed an embedded (convergent) mixed methods design, which included surveys and interviews. They developed an overall qualitative and quantitative results matrix using merging that contained the predictors identified from regression analysis of the survey data, a summary of the quantitative findings and a summary of the qualitative findings. In the final column, the authors indicated whether the qualitative findings confirmed, disconfirmed or expanded the quantitative findings, as well as the mixed methods interpretations that resulted

Table 4
Data transformation and comparison.

Predictors of migration intention	Summary of survey findings	Summary of interview findings
Nursing as first choice	Respondents who indicated that nursing was not their first choice were more likely to express migration intention (*Standardised beta:* 0.14, *p*: 0.001).	*Confirmatory findings:* Participants who reported that nursing was not their first choice also reported an intention to migrate abroad for a range of reasons (Bobby, Mausami, Eiti, Jashmine, Kamala). *Complementary findings:* Participants with nursing as first choice felt 'duty-bound', to care for the poor, sick and elderly in Nepal, and were less likely to express an intention to migrate abroad (Diana, Annie, Luja). *Contradictory findings:* Participants though have nursing as first choice may intend to migrate abroad temporarily for higher education or gaining experience of working overseas (Sara, Rosy).
Professional identity	Respondents with lower levels of professional identity had higher levels of migration intention scores (*Standardised beta:* 0.11, $p < 0.018$).	*Confirmatory findings:* One participant stated that she was not proud to be introduced as a nurse in Nepal, and the same participant stated that she took up nursing with the intention to migrate and increase her earning capacity overseas (Jashmine). *Complementary findings:* Participants believed that nurses educated overseas were highly respected by the public and other health professionals in Nepal, hence, they intended to migrate abroad to pursue further education to gain that recognition upon their return (Sara, Muna). *Contradictory findings:* Participants felt proud to introduce themselves as a nurse even if they were dissatisfied with nurses' professional status in Nepal, and at the same time, these participants also expressed an intention to migrate (Eiti, Kamala, Muna).

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TABLE 2 (Continued)

Joint display and features	Potential templates and examples of joint displays from published literature
Integrated matrix • Include integrated qualitative results • Include integrated quantitative results • Include quotes supporting the quantitative data • Include inferences generated from the data	McCrudden et al. (2016) conducted an explanatory sequential mixed methods study to examine the extent of applicability of author expertise and content relevance secondary level students during their selection of documents for a class presentation that pertained to more familiar and less familiar social-scientific topics. The authors illustrated their combined results in the form of an integrated matrix with exemplar quotes from the qualitative data after applying the merging integration procedure

Table 3

Integrated Results Matrix

Quantitative results	Qualitative results	Exemplar quote
When the topic was *more* familiar (climate change) and cards were more relevant, participants' placed *less* value on author expertise.	When an assertion was considered to be *more* familiar and considered to be general knowledge, participants perceived *less* need to rely on author expertise.	P144: "I feel that I know more about climate and there are several things on the climate cards that are obvious, and that if I sort of know it already, then the source is not so critical . . . whereas with nuclear energy, I don't know so much so then I'm maybe more interested in who says what."
When the topic was *less* familiar (nuclear power) and cards were more relevant, participants placed more value on authors with higher expertise.	When an assertion was considered to be *less* familiar and *not* general knowledge, participants perceived *more* need to rely on author expertise.	P3: "[Nuclear power], which I know much, much less about, I would back up my arguments more with what I trust from the professors."

Participant selection display • Include selection criteria • Include corresponding scores characterizing the criteria	Igo et al. (2005) conducted an explanatory sequential, mixed-methods study to determine the effect of copy-paste note-taking restrictions on students' processing, decision making and learning from a web text. In the quantitative phase, they evaluated the outcome of copy-paste note-taking restrictions on student learning. For the subsequent qualitative phase, they developed a participant selection display based on the connecting integration procedure and illustrated the choice of sample for qualitative interviews

Table 2

Qualitative Groups After Analysis of Notes and Dependent Measures Means

Distinction	Restricted strings	Restricted combinations	U1	U2	U3	U4
N	21	13	6	9	12	10
Copy-and-paste selections	Pasted existing word strings from the text	Combined words from disparate areas of the text	Pasted one sentence per cell	Pasted two sentences per cell	Pasted three sentences per cell	Pasted four or more sentences per cell
No. of words per cell	7	7	18	31	44	59
M						
Cued recall	7.8	5.0	3.8	2.8	1.3	0.3
Multiple-choice concepts	6.1	6.7	6.3	6.0	4.2	2.3
Relational inferences	5.1	3.0	2.4	1.5	1.2	0.2

Note. Copy-and-paste groups were based on general trends in individual participant's selections. U = unrestricted; U1 = students who were highly selective, choosing to paste only one sentence (approximately 18 words) per cell in the matrix; U2 = students who pasted two sentences (approximately 31 words) in the majority of cells, with perhaps some three-sentence and/or one-sentence cells; U3 = students who generally pasted three sentences in each cell (approximately 44 words, with a few exceptions); U4 = students who tended to paste four or more sentences (averaging approximately 59 words) in the majority of cells.

5 | IMPLICATIONS FOR NURSING

The decision tree has three main implications for the field of nursing. First, integration procedures and joint displays that are pertinent to the MMR design and specific to the intent of integration are instrumental in reducing any potential inaccuracies in conceptualizing and operationalizing MMR studies (Fetters, 2019; Younas, Pedersen, et al., 2020). Misuse of planned integration procedures at the data collection, analysis, reporting and interpretation levels might deteriorate the quality of MMR, thereby resulting in erroneous inferences and meta-inferences. While MMR approaches are extremely beneficial for studying and examining complex and multifaceted nursing and healthcare phenomena and processes, it is critical that studies using these approaches are conducted in the most rigorous manner so that robust inferences are generated to inform practice and policymaking (Draucker et al., 2020; Younas, Rasheed, et al., 2020). Nevertheless, the robustness of MMR is enhanced if the integration procedures and joint displays are effectively used at multiple levels within a single MMR design (Fetters, 2019). The use of these methods should also be in line with the MMR design chosen and the intent for choosing such design over other designs (Creswell & Plano Clark, 2018). Therefore, nurse researchers can use

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this decision tree to choose the most appropriate integration technique and procedures to overcome the integration challenge when designing and conducting MMR studies.

Second, based on our experience teaching MMR courses and workshops, students frequently lack expertise with available tools for integrating quantitative and qualitative data and findings. Due to the novelty of integration strategies and the fact that only a few typologies have been published, in our view, the dissemination of integration procedures and techniques has been fragmented, as authors come from a variety of disciplinary backgrounds (e.g. family medicine, nursing, education, sociology and management) and the suggested procedures and techniques do not build on previously published ones. This dispersed dissemination may cause researchers new to the field to overlook these strategies, thereby minimizing their ability to achieve the full potential of MMR designs when implementing them. By outlining the range of strategies available and linking them to their intended purposes, the decision tree may help overcome some of these problems.

Third, despite the calls to use advanced integration methods and processes in MMR in nursing, recent methodological reviews of the use of MMR in nursing (Irvine et al., 2020; Younas, Pedersen, et al., 2019) reveal that many nurse researchers fail to make explicit the integrative thinking in their MMR studies. Limited emphasis on explicating integrative thinking speaks to the lack of intentional integration in MMR projects. This lack of integration may cause researchers to overlook critical contributions of MMR to nursing, such as the production of detailed knowledge about patients' health circumstances, the strengthening of the evidence for intervention effectiveness, or the enhancement of knowledge transferability to practice (Fàbregues & Paré, 2018). To overcome this problem, the decision tree offers researchers with 14 integration procedures and 16 joint displays for easy-to-use decision making for explaining integrative thinking and processes and achieving meaningful integration in MMR studies.

6 | CONCLUSIONS

Nurse researchers employ MMR to study complex nursing phenomena and health-human care processes. Nevertheless, achieving effective integration remains a challenge in nursing mixed methods studies. Overcoming the integration challenge in MMR in nursing is of utmost importance because integration is the hallmark of a high-quality mixed methods study and differentiates it from multi- and mono-method studies. Integration procedures and joint displays are the most widely used methods for tackling the integration challenge in MMR. The multifaceted formats of these methods are beneficial for their tailored and adapted use when designing and conducting MMR in nursing. Since the use of the most pertinent integration procedures and joint displays is critical for enhancing the quality of MMR, the decision tree is proposed so that novice, as well as expert MMR nurse researchers, can make quick decisions concerning the relevant integration procedure and joint display for each particular MMR study.

AUTHOR CONTRIBUTIONS

All authors have agreed on the final version and meet at least one of the following criteria (recommended by the ICMJE*): (1) substantial contributions to conception and design, acquisition of data or analysis and interpretation of data; (2) drafting the article or revising it critically for important intellectual content. *http://www.icmje.org/recommendations/. Made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data: Ahtisham Younas and Angela Durante. Involved in drafting the manuscript or revising it critically for important intellectual content: Ahtisham Younas and Angela Durante. Given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content: Ahtisham Younas and Angela Durante. Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: Ahtisham Younas and Angela Durante.

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CONFLICT OF INTEREST

No conflict of interest has been declared by the author(s).

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DATA AVAILABILITY STATEMENT

Not applicable.

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REFERENCES

Bazeley, P. (2018). *Integrating analyses in mixed methods research*. Sage.
Creamer, E. G. (2018). *An introduction to fully integrated mixed methods research*. Sage.
Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). Sage.
Crooks, V. A., Giesbrecht, M., Castleden, H., Schuurman, N., Skinner, M., & Williams, A. (2018). Community readiness and momentum: Identifying and including community-driven variables in a mixed-method rural palliative care service siting model. *BMC Palliative Care*, *17*(1), 1–12. https://doi.org/10.1186/s12904-018-0313-5
Draucker, C. B., Rawl, S. M., Vode, E., & Carter-Harris, L. (2020). Integration through connecting in explanatory sequential mixed

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method studies. *Western Journal of Nursing Research*, *42*(12), 1137–1147.

Durante, A., Ahtisham, Y., Cuoco, A., Boyne, J., Brawner, B., Juarez-Vela, R., & Vellone, E. (2022). Informal caregivers of people with heart failure and resilience: A convergent mixed methods study. *Journal of Advanced Nursing*, *78*(1), 264–275. https://doi.org/10.1111/jan.15078

Ertesvåg, S. K., Sammons, P., & Blossing, U. (2021). Integrating data in a complex mixed-methods classroom interaction study. *British Educational Research Journal*, *47*(3), 654–673.

Fàbregues, S., & Paré, M. H. (2018). Appraising the quality of mixed methods research in nursing: A qualitative case study of nurse researchers' views. *Nursing Inquiry*, *25*(4), e12247. https://doi.org/10.1111/nin.12247

Fetters, M. D. (2019). *The mixed methods research workbook: Activities for designing, implementing, and publishing projects*. Sage.

Fetters, M. D., Curry, L. A., & Creswell, J. W. (2013). Achieving integration in mixed methods designs—Principles and practices. *Health Services Research*, *48*(6pt2), 2134–2156. https://doi.org/10.1111/1475-6773.12117

Gellerstedt, L., Medin, J., Kumlin, M., & Karlsson, M. R. (2019). Sleep as a topic in nursing education programs? A mixed method study of syllabuses and nursing students' perceptions. *Nurse Education Today*, *79*, 168–174.

Guetterman, T. C., Fàbregues, S., & Sakakibara, R. (2021). Visuals in joint displays to represent integration in mixed methods research: A methodological review. *Methods in Psychology*, *5*, 100080.

Guetterman, T. C., Fetters, M. D., & Creswell, J. W. (2015). Integrating Quantitative and Qualitative Results in Health Science Mixed Methods Research Through Joint Displays. *Annals of family medicine*, *13*(6), 554–561. https://doi.org/10.1370/afm.1865

Hammerschmidt, J., & Manser, T. (2019). Nurses' knowledge, behaviour and compliance concerning hand hygiene in nursing homes: A cross-sectional mixed-methods study. *BMC Health Services Research*, *19*(1), 1–13. https://doi.org/10.1186/s12913-019-4347-z

Hayes, B., Bonner, A., & Douglas, C. (2015). Haemodialysis work environment contributors to job satisfaction and stress: A sequential mixed methods study. *BMC Nursing*, *14*(1), 1–13.

Igo, L. B., Bruning, R., & McCrudden, M. T. (2005). Exploring differences in students' copy-and-paste decision making and processing: A mixed-methods study. *Journal of Educational Psychology*, *97*(1), 103–116. https://doi.org/10.1037/0022-0663.97.1.103

Irvine, F. E., Clark, M. T., Efstathiou, N., Herber, O. R., Howroyd, F., Gratrix, L., Sammut, D., Trumm, A., Hanssen, T. A., Taylor, J., & Bradbury-Jones, C. (2020). The state of mixed methods research in nursing: A focused mapping review and synthesis. *Journal of Advanced Nursing*, *76*(11), 2798–2809. https://doi.org/10.1111/jan.14479

Jokiniemi, K., Meretoja, R., & Pietilä, A. M. (2018). Constructing content validity of clinical nurse specialist core competencies: Exploratory sequential mixed-method study. *Scandinavian Journal of Caring Sciences*, *32*(4), 1428–1436. https://doi.org/10.1111/scs.12588

King, G., Gibson, B. E., Mistry, B., Pinto, M., Goh, F., Teachman, G., & Thompson, L. (2014). An integrated methods study of the experiences of youth with severe disabilities in leisure activity settings: The importance of belonging, fun, and control and choice. *Disability and Rehabilitation*, *36*(19), 1626–1635. https://doi.org/10.3109/09638288.2013.863389

McCrudden, M. T., Marchand, G., & Schutz, P. A. (2021). Joint displays for mixed methods research in psychology. *Methods in Psychology*, *5*, 100067. https://doi.org/10.1016/j.metip.2021.100067

McCrudden, M. T., Stenseth, T., Bråten, I., & Strømsø, H. I. (2016). The effects of topic familiarity, author expertise, and content relevance on Norwegian students' document selection: A mixed methods study. *Journal of Educational Psychology*, *108*(2), 147–162.

Moran-Ellis, J., Alexander, V. D., Cronin, A., Dickinson, M., Fielding, J., Sleney, J., & Thomas, H. (2006). Triangulation and integration: Processes, claims and implications. *Qualitative Research*, *6*(1), 45–59. https://doi.org/10.1177/1468794106058870

Morse, M. J., & Niehaus, L. (2009). *Mixed method design: Principles and procedures. Mixed method design: Principles and procedures*. Left Coast Press.

Onwuegbuzie, A. J., & Johnson, R. K. (2006). The validity issue in mixed research. *Research in the Schools*, *13*(1), 48–63.

Pluye, P., Bengoechea, E. G., Granikov, V., Kaur, N., & Tang, D. L. (2018). A world of possibilities in mixed methods: Review of the combinations of strategies used to integrate the phases, results, and qualitative and quantitative data. *International Journal of Multiple Research Approaches*, *10*(1), 1–16.

Polachek, A. J., & Wallace, J. E. (2018). The paradox of compassionate work: A mixed-methods study of satisfying and fatiguing experiences of animal health care providers. *Anxiety, Stress, and Coping*, *31*(2), 228–243. https://doi.org/10.1080/10615806.2017.1392224

Poudel, C., Ramjan, L., Everett, B., & Salamonson, Y. (2018). Exploring migration intention of nursing students in Nepal: A mixed-methods study. *Nurse Education in Practice*, *29*, 95–102.

Rasheed, S. P., Sundus, A., Younas, A., Fakhar, J., & Inayat, S. (2021). Development and testing of a measure of self-awareness among nurses. *Western Journal of Nursing Research*, *43*(1), 36–44.

Rheault, H., Coyer, F., & Bonner, A. (2021). Chronic disease health literacy in first nations people: A mixed methods study. *Journal of Clinical Nursing*, *30*(17–18), 2683–2695. https://doi.org/10.1111/jocn.15757

Sundus, A., Younas, A., Fakhar, J., & Sughra, U. (2020). Pakistani nursing students' perspectives of compassion: A convergent mixed methods study. *Journal of Professional Nursing*, *36*(6), 698–706. https://doi.org/10.1016/j.profnurs.2020.09.014

Tashakkori, A. M., Johnson, R. B., & Teddlie, C. B. (2021). *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences* (2nd ed.). Sage.

van Zelm, R., Coeckelberghs, E., Sermeus, W., Wolthuis, A., Bruyneel, L., Panella, M., & Vanhaecht, K. (2021). A mixed methods multiple case study to evaluate the implementation of a care pathway for colorectal cancer surgery using extended normalization process theory. *BMC Health Services Research*, *21*(1), 11. https://doi.org/10.1186/s12913-020-06011-w

Younas, A., Pedersen, M., & Durante, A. (2020). Characteristics of joint displays illustrating data integration in mixed-methods nursing studies. *Journal of Advanced Nursing*, *76*(2), 676–686. https://doi.org/10.1111/jan.14264

Younas, A., Pedersen, M., & Inayat, S. (2022). Practical strategies to identify and address discordant findings in mixed methods research. *Research Methods in Medicine & Health Sciences*, 263208432211223. https://doi.org/10.1177/26320843221122342

Younas, A., Pedersen, M., & Tayaben, J. L. (2019). Review of mixed-methods research in nursing. *Nursing Research*, *68*(6), 464–472. https://doi.org/10.1097/NNR.0000000000000372

Younas, A., Rasheed, S. P., Zeb, H., & Inayat, S. (2020). Data integration using the building technique in mixed-methods instrument development: Methodological discussion. *Journal of Advanced Nursing*, *76*(8), 2198–2207.

Younas, A., & Sundus, A. (2022). Tripartite analysis: A data analysis technique for convergent mixed methods designs. *Nursing Research*, *71*, 313–321. https://doi.org/10.1097/nnr.0000000000000584

Younas, A., Zeb, H., Aziz, S. B., Sana, S., Albert, J. S., Khan, I. U., Inayat, S., Khan, F. H., & Rasheed, S. P. (2019). Perceived challenges of nurse educators while teaching undergraduate nursing students in Pakistan: An exploratory mixed-methods study. *Nurse Education Today*, *81*, 39–48. https://doi.org/10.1016/j.nedt.2019.07.002

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