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Practical Applications of Qualitative and Quantitative Approaches in Interdisciplinary Sciences: A New Perspective

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Abstract: *Discussions regarding the choice of quantitative and qualitative methods for addressing research questions within the intra-individual study design are well established. However, little discussion has focused on how researchers look beyond research designs in a single layer and context. This article describes a hybrid research framework using both qualitative and quantitative methods at four different research levels in the highly interdisciplinary field of occupational science and occupational therapy. The aim is to illustrate that multiple research methods have broad research applications in a large methodological framework, beyond research designs that focus on methods within a single study. This article discusses an interdisciplinary approach to research design and knowledge generation across research levels, which is essential for successful implementation of evidence-based practice. In interdisciplinary sciences, qualitative and quantitative methods work best when maximizing the capacity to bridge science and practice. Researchers need to apply appropriate qualitative, quantitative, and mixed methods approaches to suit the specific needs at various levels of the science-practice interface.*

Keywords: Interdisciplinary research; mixed methods; qualitative; quantitative; research levels

Introduction

A combination of quantitative and qualitative methods has been widely used to generate evidence of the effectiveness of health prevention, services, and intervention programs (Zhang and Watanabe-Galloway, 2014). Much has been discussed regarding the choice of quantitative and qualitative methods based on the discipline, research questions, and approach to a study. Little work has been done to address the role of qualitative and quantitative methods at various research levels within a disciplinary area, beyond the intra-individual study design. In this paper, a framework from a highly interdisciplinary field of Occupational Science and Occupational Therapy (OSOT) is discussed to illustrate the practical applications of qualitative and quantitative approaches across research levels in Evidence-Based Practice (EBP).

Within OSOT, occupations refer to all activities that individuals or groups engage. Occupational Therapy (OT) is a health care profession aimed at improving performance, preventing illness and promoting adaptation to life changes. Occupational science (OS) is an emerging field of study which supports the practice of OT. This has been regarded as an EBP among OT professionals, thus requiring the integration of practice-based knowledge (Cusick and McCluskey, 2000). OS establishes a foundation for therapeutic intervention practice and is an important knowledge source for OT (Kristensen and Petersen, 2016). This paper discusses the role of qualitative and quantitative methods, with varying degrees of emphasis at a hierarchy of research levels within OSOT, highlighted with research examples. The aim is to illustrate that multiple research methods have broad research applications in a large methodological framework, beyond research designs that focus on methods within a single study or a synthesis of an area of research. The methodologies discussed in this article can be applied to various fields to support interdisciplinary health care research.

Research framework and analytical methods

Pierce (2012) presented a set of four levels of OSOT research: descriptive research (level 1), relational research (level 2), predictive research (level 3), and prescriptive research (level 4). The lower levels support and inform research at the higher levels (Hinojosa, Kramer, and Royeen, 2017). This research hierarchy involves a coherent process from "descriptive" to "prescriptive", with level 1 being the lowest and level 4 being the highest. Qualitative and quantitative approaches are given higher or equal priority in research methods, when appropriate to the research levels of this research hierarchy.

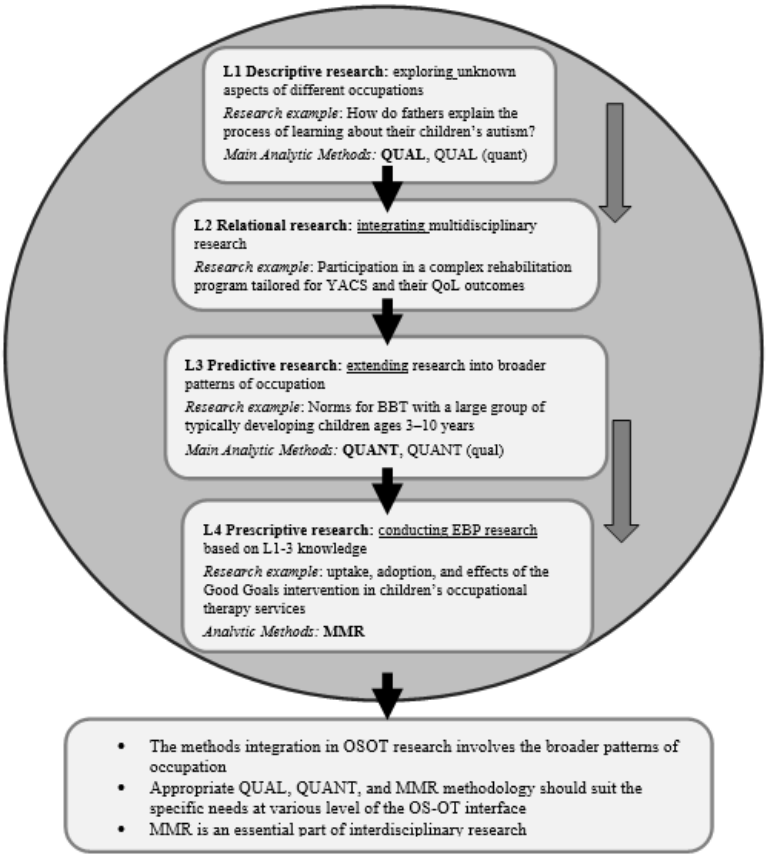
Furthermore, research within levels 2 to 4 has emphasized the integration of research and mixing in methods. Integration of research refers to the combination of research from multidisciplinary fields with that from OSOT. Mixing in methods refers to combining of quantitative and/or qualitative methods, with the method determined based on the particular research level. A diagram is drawn to illustrate this research framework and its major analytic methods (Figure 1). Analytic methods are composed of labels and abbreviated symbols to represent different aspects of research as shown in Table 1. A hybrid of qualitative and quantitative methods provides a holistic and flexible approach to understanding the complexity of occupation. Mixing methods is particularly relevant in Interdisciplinary Sciences that blends knowledge and practice in the dynamic relationship between occupation, health and quality of life.

Table 1. *Analytic methods and abbreviated symbols*

Abbreviated symbols	Definition
QUANT	A study conducted quantitatively
QUAL	A study conducted qualitatively
Qual - Quant	Quantitative secondary data in relation to qualitative data
Quant - Qual	Qualitative secondary data in relation to quantitative data

Abbreviated symbols	Definition
MMR	A study conducted using mixed methods, including QUAN → qual, QUAL → quant, QUAN+QUANT, QUAL(quant), QUANT(qual) or Embedded design
Plus sign:+	Simultaneous or concurrent collection of quantitative and qualitative data
Arrow: →	Sequential manner of data collection, e.g.: QUAN → qual, given priority over quantitative data, followed by secondary qualitative data collection
Parenthesis: ( )	Method incorporated within another larger project

Figure l. Levels of OSOT research and their main analytic methods



Applications and best practice

Level 1 research

Level 1 research has been described as the base level OS research that explores previously unknown aspects of different occupations, including their contexts. Hinojosa et al. (2017)

pointed out that the higher relational, predictive, and prescriptive levels of research in OSOT depend strongly on the descriptive work at level 1 research. In this research level, a study may attempt to describe an occupation or explore a concept. Therefore, the methodological approach for the level 1descriptive research often largely relies on qualitative methods. Pierce et al. (2010) indicated that Grounded Theory was the most common approach used in the base level OS research, followed by narrative inquiry, phenomenology and ethnography. Furthermore, a mixed methods approach with an emphasis on the qualitative research component can be applicable for level 1 research, in which qualitative research approach is a main method to guide the project.

Hannon and Hannon (2017) used qualitative grounded theory methods as a departure point to better understand how fathers respond to their children's unique needs and abilities. The grounded theory approach is a qualitative research method that uses a systematic set of procedures to develop an inductively derived grounded theory about a phenomenon (Strauss and Corbin, 1998). Grounded theory approach is particularly suitable for exploring fathers' orientation to their children's autism diagnosis and describing how these fathers make meaning of their children's developmental differences. The level 1 research example illustrated that grounded theory research design is a suitable method to explore the occupation of fathers' orientation process regarding children's autism as a complex multidimensional phenomenon and to establish a theory base for OT intervention or practice. The results may trigger further research at higher levels using both qualitative and quantitative methods that sample larger and more diverse groups of fathers to determine the external validity of findings. Moreover, a small quantitative component could be incorporated into this study to enhance the research design. For example, the authors could consider adding the participating fathers' ratings for the identified themes or factors using a quantitative measurement scale.

Level 2 research

Level 2 research addresses how the core concept of occupation is related to the core concepts of other disciplines. OS knowledge is integrated with research in other disciplines at level 2. OSOT is a broad field encompassing many areas of study such as education, justice, nursing and public health (Wilcock, 2001). At level 2, OS knowledge is integrated with research in other disciplines. Level 2 relational research is *inherently interdisciplinary* because it integrates core concepts of multiple disciplines from social and health sciences. A prominent developing area is the relation of occupation and Quality of Life (QoL) research. The adequacy and depth of this level of research is highly associated with full and theoretically developed descriptions at level 1. The methodological approach at the relational research level could be mixed methods, quantitative, and/or qualitative, depending on the nature of the research project.

A mixed methods approach is well adapted in studying rehabilitation process and QoL outcomes. The overall aim of the Hauken et al.'s study (2019) was to develop an enriched understanding of both the rehabilitation process and outcomes in evaluating a complex rehabilitation program for Young Adult Cancer Survivors (YACS). The qualitative and quantitative results in this study support and elaborate each other. The qualitative findings

provide further insight into how the participants experienced this process. The overall findings highlight that health care professionals need to become more knowledgeable about YACS' specific survivorship challenges. An empirical mixed methods approach would be ideal for the level 2 relational research study. Medicine is concerned with preserving life, while OT is concerned with the QoL preserved of a person following illness, injury or disability (Yerxa, 1990). In order to capture the complexity of QoL assessment, the use of both quantitative and qualitative methods in QoL research is growing (Ring, Gross, and McColl, 2010). Research on QoL has focused on traditional functional measures using validated quantitative instruments or performance components such as range of motion and measurements (Liddle and McKenna, 2000). However, the qualitative approach is also important for relational research, as occupation requires the interaction of the individual with his or her particular context. The level 2 research is set to provide important knowledge to support OT practice. The ultimate goal of OSOT research is to improve the QoL for people with disabilities and special needs through therapeutic intervention.

Level 3 research

Level 3 research offers knowledge that allows the general prediction of typical patterns of occupation. Therefore, predictive research in OSOT requires more than descriptive qualitative work to reach its potential. Furthermore, research at level 3 extends the discoveries of descriptive and relational research to research into the broader patterns of occupation, over populations, time, space, and social conditions. Hence, it requires methods and occupational instruments better suited to the study of large samples. These studies often use rigid quantitative methods and include a large number of participants. Mixed methods with a strong quantitative component are also suitable, using an abbreviated symbol of Quant-Qual in the diagram (Table 1 and Figure 1).

The Box and Block Test (BBT) is a simple test for assessing gross manual dexterity. The BBT is especially suitable for very young children. Jongbloed-Pereboom et al.'s (2013) illustrates quantitative procedures and statistical tests for validity and reliability applied in the predictive research level. The quantitative evidence indicates that the BBT is a practical and suitable test to administer in a therapeutic or research setting. The BBT is appropriate for evaluating manual dexterity in young children. As the authors noted, the obtained norms from this study could be used in clinical settings to compare the gross manual dexterity of atypically developing children with that of age-related peers and to evaluate efficacy of interventions. In clinical practice, children with unilateral cerebral palsy may specifically benefit from early intervention aimed at improving hand function. Level 3 predictive research emphasizes quantity, as well as reliability and validity. Research at this level may use the knowledge and experiences derived from the lower level of OS research. In this study, the BBT has been researched and documented as a quick and simple test for testing hand function and motor control. This study illustrated an empirical quantitative approach for addressing reliable and valid measurements and analysis. Moreover, mixed methods research design that adds secondary qualitative data in relation to quantitative data can potentially enhance study validity beyond traditional statistical methods and provide greater insights. For instance, researchers could consider using

qualitative open-ended questions for aiding the quantitative instrument and enhancing rigor (Frels and Onwuegbuzie, 2013).

Level 4 research

Level 4 prescriptive research has an applied emphasis in EBP-based research. Although EBP encompasses more than just application of the best available research evidence, many of the concerns and barriers to using EBP revolve around finding and applying research. The central premise of research at level 4 is the way in which OS research is to be addressed through effective interventions in OT practice through various occupation-based practice venues, including hospitals and community settings such as home and school (Wilcock, 2001). It is critical that occupational therapy move beyond seeing practice in a decontextualized way in order to consider how the setting of interventions impacts their effectiveness. OT interventions need to emphasize that the relationships among the person, environment and occupation are interlinked and mutually reinforcing (Kreider et al., 2014). Further, clinical experience influences whether, how, and to what extent research evidence is integrated into practice (Thomas and Law, 2013). Therefore, a mixed methods approach is best suited for this prescription research level. For example, researchers may collect qualitative information on participants' input and on the research site's context, and collect quantitative measures from participants at different points throughout the intervention. The central premise of a level 4 study is research involving intervention and implementation.

Kolehmainen et al. (2012) investigated the use of *Good Goals* in the context of children's occupational therapy specifically. The authors blended both qualitative and quantitative research components concurrently and sequentially to study uptake, adoption, and effects of the Good Goals intervention in children's occupational therapy services. Overall, the integration of the qualitative and quantitative data has both features of sequential and concurrent mixed methods embedded designs (e.g., complementing findings from one source with findings from another; drawing on one source of data to follow up and extend findings from another) (Creswell and Plano Clark, 2011). A mixed methods approach was proven effective through the application of qualitative components at various phases of the research to study the intervention process and the way in which this affected intervention outcomes and impacts. OT practitioners may benefit from the study results applicable at their practice in the context of children's therapy. Good Goals intervention helped therapists establish a shared rationale for making effective clinical decisions, increasing clarity in service provision, and improving interactions with families and schools. At level 4 prescriptive study, the EBP-based research involves both sequential and concurrent use of qualitative and quantitative methods during the research process. The emphasis on both quality and quantity may facilitate and enhance the interpretation of study results in order to emphasize the practical implications of a study. This study indicates that clinicians providing "good goals" intervention services in the context of children's therapy may benefit from the theory in their creation and modeling of the practice of change intervention in OT. Due to the interactive nature of OSOT research, new concepts or phenomena could emerge during or after a level 4 study. For example, the investigators might conduct a subsequent ethnography of occupational therapists in the context

of children's therapy to learn more about issues related to the access and equity in children's therapy services and clinicians' use of resources.

Discussion and Implications

A hybrid of qualitative and quantitative methods could be a good approach to capture the dynamic iterations of EBP-based research in interdisciplinary sciences, with priority given respectively to qualitative or quantitative methods at the different research levels. EBP-based research is deemed to be *prescriptive*, and research at this level uses the knowledge and experiences derived from the lower level. The "prescriptive" research needs to move beyond decontextualized research practices to consider how the applied settings and processes impact their effectiveness. It is possible that the proposed intervention strategies are not appropriate to achieve the intended objectives in the particular context. Therefore, the adoption of mixed methods is essential to this stage as is the need to incorporate a range of potential local contexts for project implementation. Qualitative techniques (e.g. participant observation, key informant interviews and focus groups) can be used to assess the process of intervention implementation. This information can then be used to guide analysis, interpret the study findings, and refine the intervention in future practices.

Using the OSOT research framework as an illustration, the integration of qualitative and quantitative approaches in multidisciplinary research studies clearly involves a dynamic process. This process is grounded in core principles of occupation and influenced by emerging knowledge and practice patterns, which applies for all type of EBP in various fields of social and health sciences. Research constructs in EBP are multidimensional and hence require a coherent bridging of quality and quantity in research methods. Combining a mixed methods framework with discipline-specific models allows for the development of a comprehensive yet practical methodological template (Zhang, 2014).

This discussion provides important insight into linking quality and quantity in interdisciplinary sciences and applications, beyond merely discussing intra-individual study research methods. The exemplar studies discussed in this article were selected to illustrate OSOT empirical research methods at four different hierarchical levels. Thus, evidence synthesis methods such as systematic review were not used. The larger message here is that EBP is a coherent research process from "descriptive" (understanding a concept or the acquisition of its basic data) to "prescriptive" (applications and best practice). In clinical research, researchers are inevitably more familiar with the randomized controlled trial research (RCT) and regard RCT as the "gold standard". For health researchers, it is not appropriate to consider a single method (e.g. qualitative approach, quantitative approach) as the *gold standard* in research. Spector (2017) indicates that a healthy science needs a good balance of inductive, abductive, and deductive approaches to research inquiry, and urges researchers to utilize all three approaches to advance research discoveries. Qualitative, quantitative, and mixed methods approach should be emphasized at different levels during the research process.

Conclusion

Qualitative and/or quantitative methods work best when maximizing their capacity to bridge science and practice. Therefore, researchers need to apply appropriate qualitative, quantitative, and mixed methods approaches to suit the specific needs at various levels of the science-practice interface. A hybrid research framework could be a good approach to capture the dynamic iterations of evidence-based health care, with priority given respectively to qualitative or quantitative methods at the different research levels. The methodologies discussed in this article can be applied to various fields to support interdisciplinary research. The research community needs an approach that brings together the science and the practice in the larger context of a particular disciplinary area. This article provides a new perspective on the way that researchers look beyond research designs in a single layer and context.

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