Document generated on 08/11/2025 12:56 a.m.

The Canadian Journal of Information and Library Science
La Revue canadienne des sciences de l'information et de bibliothéconomie

Integrating quantitative and qualitative data in mixed methods research: An illustration

Intégration de données quantitatives et qualitatives dans la recherche par méthodes mixtes : un exemple

Africa S. Hands

Volume 45, Number 1, 2022

URI: https://id.erudit.org/iderudit/1090604ar
DOI: https://doi.org/10.5206/cjilsrcsib.v45i1.10645

See table of contents

Publisher(s)

Canadian Association for Information Science - Association canadienne des sciences de l'information

ISSN

1195-096X (print)
1920-7239 (digital)

Explore this journal

Cite this article

Hands, A. (2022). Integrating quantitative and qualitative data in mixed methods research: An illustration. *The Canadian Journal of Information and Library Science / La Revue canadienne des sciences de l'information et de bibliothéconomie*, *45*(1), 1–20. https://doi.org/10.5206/cjilsrcsib.v45i1.10645

Article abstract

Employing a mixed methods approach to research is meant to deliver a comprehensive examination of the phenomenon under study. An integral step in mixed methods research is integrating qualitative and quantitative data. However, published reports rarely detail the process of mixing data from both approaches. Presented here is an illustration of integrating qualitative and quantitative data sets using a convergence table. A review of mixed methods research in LIS is presented, and a reflection on the challenges of integration is shared. As the mixed methods approach increases in LIS research, the example offered here aims to make integration more transparent.

© Africa S. Hands, 2022

This document is protected by copyright law. Use of the services of Érudit (including reproduction) is subject to its terms and conditions, which can be viewed online.

https://apropos.erudit.org/en/users/policy-on-use/

This article is disseminated and preserved by Érudit.

Érudit is a non-profit inter-university consortium of the Université de Montréal, Université Laval, and the Université du Québec à Montréal. Its mission is to promote and disseminate research.

https://www.erudit.org/en/

Integrating quantitative and qualitative data in mixed methods research: An illustration

Intégration de données quantitatives et qualitatives dans la recherche par méthodes mixtes : Un exemple

Africa S. Hands
East Carolina University

Abstract: Employing a mixed methods approach to research is meant to deliver a comprehensive examination of the phenomenon under study. An integral step in mixed methods research is integrating qualitative and quantitative data. However, published reports rarely detail the process of mixing data from both approaches. Presented here is an illustration of integrating qualitative and quantitative data sets using a convergence table. A review of mixed methods research in LIS is presented, and a reflection on the challenges of integration is shared. As the mixed methods approach increases in LIS research, the example offered here aims to make integration more transparent.

Keywords: mixed methods, data integration, qualitative research, quantitative research, doctoral students

Résumé : Le recours à l'approche par méthodes mixtes en recherche vise à fournir un examen complet d'un phénomène étudié. L'intégration de données qualitatives et quantitatives fait partie intégrante de la recherche par méthodes mixtes. Cependant, les rapports publiés ne détaillent que rarement le processus unissant des données issues des deux approches. Un exemple d'intégration de jeux de données qualitatives et quantitatives à l'aide d'un tableau de convergence est présenté ici. Une revue de la recherche par méthodes mixtes dans le domaine de la bibliothéconomie et des sciences de l'information est présentée, et une réflexion des défis liés à l'intégration est partagée. L'approche par méthodes mixtes en recherche étant de plus en plus utilisée en bibliothéconomie et sciences de l'information, l'exemple proposé vise à rendre le processus d'intégration de données plus transparent.

Mots clés : méthodes mixtes, intégration des données, recherche qualitative, recherche quantitative, étudiants au doctorat

Introduction

The mixed methods approach to research studies surfaced over thirty years ago. The early years of mixed methods research saw a focus on defining the research

© The Author 2022. Canadian Journal of Information and Library Science

La Revue canadienne des sciences de l'information et de bibliothéconomie, Vol. 45 (2022), No. 1
https://doi.org/10.5206/cjilsrcsib.v45i1.10645

approach. Johnson, Onwuegbuzie, and Turner (2007) analyzed 19 scholars' definitions of mixed methods landing on the inclusive definition used in the present study:

> Mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration. (123)

Concerns about mixed methods research also centered on a researcher's adherence to epistemological paradigms because of the combining of qualitative and quantitative approaches. These "paradigm wars" (Morgan 2007) inevitably were accompanied by questions about integration (Creswell and Plano Clark 2011).

Several definitions of "integration" appear in the literature with subtle differences about what to integrate, when to integrate, and how to display integration in published reports (Bryman 2007; Creamer 2017; Fetters and Molina-Azorin 2017; Plano Clark 2019). Plano Clark's (2019) explanation of integration offers flexibility concerning the *what*, *when*, and *how* of integration while observing the essence of integration in mixed methods research, and thus is applied to the current research. According to Plano Clark (2019), integration is an "explicit conversation between (or interrelating of) the quantitative and qualitative components of a mixed methods study" (108). The components include qualitative and quantitative perspectives, methodologies, data sources, and approaches to data analyses.

A full discussion of mixed methods design types is not the focus of this article; readers are referred to Creswell and Plano Clark (2011; 2018) for an explanation. Plano Clark (2019) noted some connections between design types and integration in three core mixed methods designs. Integration can occur by merging quantitative and qualitative analyses followed by an integrative interpretation (for example, in convergent mixed methods designs); in the connecting of quantitative analysis to inform the qualitative phase of a study also followed by an integrative interpretation (explanatory mixed methods); and conversely, in the connecting of qualitative analysis to inform the quantitative phase of a study, again followed by an integrative interpretation (exploratory mixed methods). The current study resembles a convergent mixed method design wherein "a researcher collects both quantitative and qualitative data, analyzes them separately, and then compares the results to see if the findings confirm or disconfirm each other" (Creswell 2014, 219). However, as an exploratory study, the intent of using two types of data was to generate a more complete representation of doctoral student motivation rather than to confirm or disconfirm as might be the case if taking a hypothetico-deductive approach.

Though integration of qualitative and quantitative approaches is an essential component of mixed methods research, barriers or challenges encountered when integrating qualitative and quantitative approaches have been noted. Bryman (2007) identified integration-related barriers that are noticeable during the publication stage of research such as attention to the expectations of one's research audience toward one or the other type of data influencing what is reported, researcher's preference or intrinsic

interest for qualitative or quantitative research, a study design that lacks attention to integration, and the qualitative and quantitative phases occurring out of sync with one's publishing timeline (Bryman 2007). While lack of exemplars was not cited as a barrier, neither could researchers identify an exemplar of mixed methods research, leading Bryman (2007) to call for attention to the integration of qualitative and quantitative data sets in the published literature. Further, even with the importance placed on integration, an analysis of a corpus of non-library and information science mixed methods studies found that qualitative and quantitative findings were barely integrated (Bryman 2006). Still today, "questions about how to effectively integrate diverse methods are still the fundamental issues faced by researchers using mixed methods research" (Plano Clark 2019, 106). This was the author's struggle as well.

Attempts have been made to clarify the process of integration (Creamer 2017; Morgan 2014); however, integration is discussed in broad terms rather than demonstrated explicitly (Johnson, Grove, and Clarke 2017). Some helpful examples of integration exist in the health sciences literature. For example, Johnson, Grove, and Clarke (2017) illustrated the Pillar Integration Process (PIP), a four-stage post-analysis technique of systematically coding, transforming, and condensing into categories the two data sets, followed by pillar building to create meta-themes. "Following a thread," an integration technique developed by Moran-Ellis et al (2006), prioritizes an inductive analytical approach of following the thread of a finding in one set of data across the other data sets to create a "constellation of findings" (16) to gain insight on a phenomenon. Farmer et al. (2006) described another integration strategy, triangulation protocol, which entails creating a convergence coding matrix or table to identify areas of agreement, silence, and disagreement between the two types of data sets.

In library and information science (LIS), however, there are few examples of mixed methods integration. The illustration presented in this article aims to address this gap in LIS literature and invites others to share explicit integration examples to expand the body of literature for the discipline.

Mixed methods research in Library and Information Science

Though questions and challenges related to carrying out mixed methods research in general, and integration specifically, have been broadly noted (Bryman 2007; Plano Clark 2019), mixed methods research is still in a nascent stage of use in library and information science research. Over the last 14 years, five studies—summarized in Table 1—have emerged as notable examinations of mixed methods research in LIS (Fidel 2008; Chu 2015; Crist and Berman 2016; Julien and Fena 2018; Granikov et al. 2020). Fidel's (2008) analysis of four LIS journals (*Information Processing and Management, Journal of Documentation, Journal of the American Society for Information Science and Technology,* and *Library and Information Science Research*) identified 39 of 465 articles employing both qualitative and quantitative approaches or multiple methods, though, just 22 articles (or 5% of the total examined) could be classified as employing a mixed methods approach (i.e., qualitative and quantitative approaches were actually mixed or integrated). The mixed methods approaches could have been more prevalent than

appeared and possibly unlabeled or mislabeled in the literature, presenting a classification challenge for Fidel (2008) as well as for other researchers seeking to learn the specifics of mixed methods via examples in the published literature.

Author(s)	Data source	Publication period of sample	Findings
Fidel (2008)	465 articles from 4 journals	2005-2006	22 articles employed mixed methods
Chu (2015)	1,162 articles from 3 journals	2001-2002 and 2009-2010	84 articles used at least two methods; unclear how integration was implemented
Crist and Berman (2016)	202 articles pulled from 2 LIS databases	2013-2016	55 articles met the inclusion criteria for further review
Julien and Fena (2018)	Articles in 1 journal	1986-2017	37 articles employed mixed methods
Granikov et al. (2020)	386 articles pulled from 2 LIS databases	2017-2018	84 articles utilized mixed methods and integration; 65 articles self-identified as mixed methods

Table 1: Studies of mixed methods in LIS research

Since Fidel's analysis, researchers saw some increase in reported use of multiple methods by LIS researchers, although the extent to which these studies may be classified as mixed methods was uncertain. In a nod to Fidel's (2008) study, Chu (2015) investigated types of research methods reported in three of the four aforementioned journals (excluding *Information Processing and Management*), over two time periods. Because the full range of research methods was examined, the corpus of publications was much larger than Fidel's (1,162 articles compared to 465 articles). Overall, between 2001-2002 and 2009-2010, more articles reported using multiple methods with two methods being the most observed combination. Using a broader publication period but just one journal, Julien and Fena (2018) observed that 37 empirical studies published in *Canadian Journal of Information and Library Science* between 1986 and 2017 utilized mixed methods.

The studies mentioned thus far were limited in scope. The number of articles identified as using a mixed methods approach varied based on journal, publication period, and both the researchers' and examiners' interpretation of what constituted mixed methods and integration. The mix of interpretation regarding integration is

unsurprising as Maxwell and Loomis (2003, 256) wrote, "uncovering the actual integration of qualitative and quantitative approaches in any particular study is a considerably more complex undertaking than simply classifying the study." Instead of focusing on select journals, which automatically narrows the pool of possible articles that may serve as exemplars of mixed methods research, Crist and Berman (2016) and Granikov et al. (2020) investigated the presence of mixed methods research in LIS by conducting bibliographic searches in LIS-specific databases. Crist and Berman (2016) searched *Library, Information Science & Technology Abstracts* and *Library Literature & Information Science Full Text* databases; Granikov et al. (2020) searched *Library and Information Science Abstracts* and *Library, Information Science & Technology Abstracts*. Among the studies mentioned, Crist and Berman's scoping review analyzed the most expansive sample, looking at articles published over a three-year period in databases with international coverage spanning a wide variety of LIS subdisciplines. Their review identified 55 articles meeting the inclusion criteria, which—in addition to limiters on publication date, language (English), and publication type (academic journals)—included search terms to identify probable mixed methods articles. Similarly, Granikov et al. (2020) searched for articles using keywords indicative of mixed methods research. They found 65 articles, published between 2017 and 2018, that self-identified as using mixed methods and, relevant to the present study, Granikov et al.'s work included an examination of how integration was achieved in the articles. Most of the articles they reviewed described utilizing at least one integration strategy with comparing quantitative and qualitative results being the most popular strategy. This strategy is similar to what occurs in the triangulation protocol integration strategy (Farmer et al. 2006).

Reporting of mixed methods research in library and information science has shown some improvement since Fidel (2008) first described the mixed methods approach as an approach that was "applied sparingly and unsystematically" (271). According to Granikov et al.'s (2020) review, more recent articles have included the rationale for using a mixed methods approach, referred to key methodological texts, and noted the specific mixed methods design types employed. Though the articles in their sample described the integration strategy utilized, "the authors of the self-identified mixed methods articles [did] not name the strategies they use" (7). In addition to integration strategies that were not named by the articles' authors, Granikov et al.'s delineation of the integration strategies listed "divergence of qualitative and quantitative data" as an integration strategy separate from comparison. Further, the lack of articles employing the divergence strategy is significant as Pluye et al. (2009) have reported on the dearth of mixed methods literature reporting divergence. Building from Granikov et al.'s review of integration strategies, this paper aims to illustrate an instance of a comparison integration focused on both convergence and divergence of qualitative and quantitative data sets.

Overview of the original study

This illustration of mixed methods integration comes from a study examining motivational factors for earning a Ph.D. among first-year doctoral students in library and information science programs in the U.S. and Canada (Hands 2018). A mixed methods approach was selected because it supported the author's intent to generate a broad account of doctoral students' initial motivation understanding that there is not just one reason for earning the degree. While extant literature sheds light on various aspects of LIS doctoral education (e.g., program characteristics, disciplinary trends, and publication activities), the student perspective rarely has been engaged. Further, student motivation was an unexamined area of LIS doctoral education research. Because motivation can be assessed using textual data such as from interviews or quantified and classified using survey data, collecting, and analyzing only quantitative or qualitative data would not have provided the comprehensive picture of student motivation that was desired with this research. As such, data on doctoral student motivation was generated from multiple sources including a motivation instrument (quantitative), semi-structured interviews (qualitative), and participant-submitted personal admission statements (qualitative). Each approach to data collection supported a research question to examine the phenomenon of motivation in a slightly different way as shown in Table 2. Data collection, participant demographics, and theoretical framework are presented in more detail elsewhere (Hands 2018).

Research Question	Research Approach	Data Collection Method	Data Analysis
1. What motivation types are represented by students in library and information science doctoral programs?	Quantitative	Academic Motivation Scale (AMS-C 28)	Descriptive statistics
2. What initial factors motivate individuals to earn a doctoral degree?	Qualitative	Semi-structure interviews, personal admission statements	Inductive qualitative content analysis

Table 2: Questions addressed in the original study

The use of two questions and two approaches was not to triangulate or produce one-dimensional complementary results. Instead of triangulation, which aims to arrive at one view of a phenomenon based on confirmation of multiple findings, crystallization is more apt as it "celebrate[s] multiple points of view of a phenomenon across the methodological continuum" (Ellingson 2009, 22). Crystallization acknowledges the value of applying a pragmatic lens to understanding a multifaceted phenomenon, in this case earning a doctoral degree, that the researcher believed to be more nuanced than has been portrayed by traditional-minded faculty advisors. Further, it is not uncommon for mixed methods studies to examine separate and related research questions (Creswell

2014). Using mixed methods exposes "the different dimensions of a phenomenon and to enrich understandings of the multi-faceted, complex nature of the social world" (Moran et al 2006). In the present case, the original questions examined the same phenomenon—motivation. The research questions were connected in that the motivation types (further elaborated below) correspond to the motivating factors for earning a doctoral degree. This illustration addresses a single mixed methods research question that aims to support a comprehensive picture of motivation for this group of doctoral students and flexibly accounts for the qualitative and quantitative findings:

RQ: What motivates individuals to earn a doctoral degree?

Quantitative data was generated using the self-administered instrument—the Academic Motivation Scale (AMS-C 28) (Vallerand et al., 1992). A convenience sample of first-year LIS doctoral students in the United States and Canada completed an online version of the instrument. The 28-item instrument assesses motivation using seven subtypes corresponding to the motivation types described in Deci and Ryan's self-determination theory (Deci and Ryan 1985; Hands 2018). Self-determination theory (SDT), a human development-centered motivation theory, posits that behavior is influenced by an individual's social-cultural environment, which may support or hinder one's personal development and growth potential (Ryan and Deci 2017). Self-determination theory considers the *quality* of motivation, not *quantity* or amount of motivation as with other theories of motivation. Self-determination theory has been utilized to examine doctoral student attrition and completion rates, motivation of entering doctoral students, and doctoral students' motivation for choosing dissertation topics providing a basis for applying it to the present study on doctoral student motivation (Beck 2016; Cardona 2013; Kemp et al. 2014; McCarthy 2016; Mosyjowski, Daly, and Peters 2017). Hegarty (2010) and Petrelli (2014) utilized the AMS-C 28 to examine business and education graduate students and applicants of Doctor of Pharmacy programs, respectively.

Rather than view motivation through a dichotomous lens of intrinsic and extrinsic motivation, SDT depicts motivation as existing along a continuum from amotivation to intrinsic motivation depending upon one's social-cultural environment and perception of "the degree to which the motivations emanate from the self" (Ryan and Deci 2000, 72). As shown in Figure 1, the self-determination continuum serves a categorization purpose and is not based on any scale of measurement. Amotivation, at one end of the continuum, represents behavior that is non-self-determined and is unregulated. At the opposite end of the continuum is intrinsic motivation characterized by behavior that is self-determined or autonomous and regulated by one's inherent interest. Along the middle of the continuum lie four types of extrinsic motivation: external, introjected, identified, and integrated regulation (Deci and Ryan 2002; Vallerand et al. 1992). Identified regulation refers to behavior that is extrinsically motivated and for which one finds value and personal importance. Introjected regulation describes extrinsically motivated behavior based on avoidance of guilt or punishment, while external regulation refers to what has traditionally been thought of as extrinsic motivation. Integrated regulation applies to actions undertaken because of their separable, extrinsic

outcome but for which one values; it resembles intrinsic motivation but is not enacted based on interest or enjoyment.

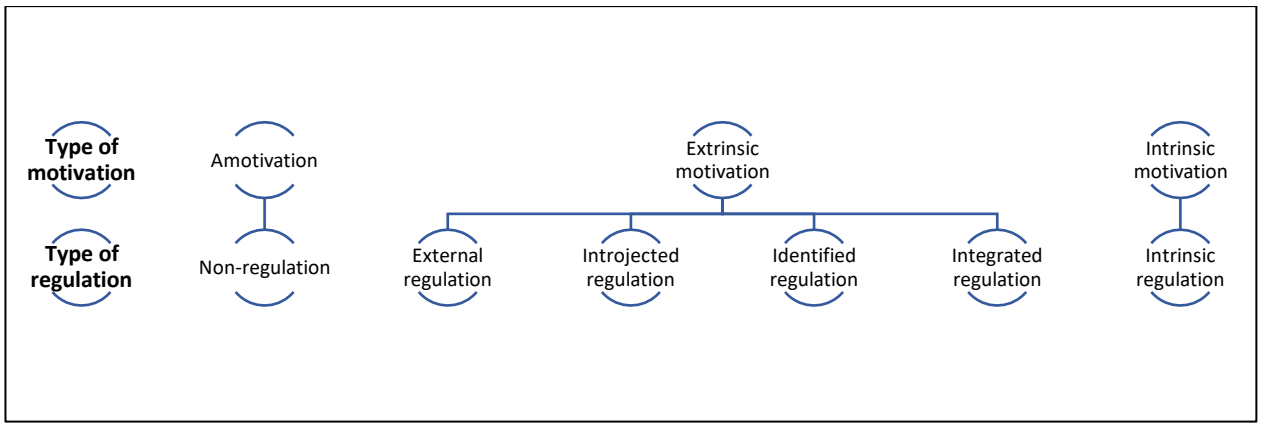

Figure 1: The self-determination continuum categorization adapted from Deci and Ryan (2002)

The seven motivation subtypes on the AMS-C 28 correspond to the motivation types on a continuum with the exception that integrated regulation is not included on the AMS-C 28 (Vallerand et al. 1992). Also, on the instrument, intrinsic motivation is divided into three types representing the pleasure or satisfaction felt when one encounters new learning experiences, when surpassing academic goals, and when engrossed in conversation or literature one finds deeply interesting. The AMS-C 28 asks participants to choose a degree of correspondence for each item on the scale representing a reason for earning a Ph.D. The responses included: *Does not correspond at all* (1), *Corresponds a little* (2 or 3), *Corresponds moderately* (4), *Corresponds a lot* (5 or 6), and *Corresponds exactly* (7).

The findings presented here are based on seven doctoral students who completed both the quantitative instrument and participated in the qualitative interviews. Acknowledging the small sample size of participants, this paper aims to illustrate a methodological procedure rather than provide a generalizable account of LIS doctoral student motivation. Cronbach's alpha—a measure of reliability used with scales—was calculated to determine the instrument's internal consistency (Vallerand et al. 1992). Alpha values can range from 0 to 1.0, with an acceptable range of 0.70 to 0.95 (Tavakol and Dennick 2011). In this study, with alpha values between 0.72 and 0.97, the AMS-C 28 was determined to have adequate levels of internal consistency (see Table 3).

AMS Subscale	Alpha (n=7)
Amotivation (AMOV)	.79
External Regulation (ER)	.72
Introjected Regulation (INTRO)	.90
Identified Regulation (IDR)	.84

Intrinsic Motivation to Know (IMK)	.91
Intrinsic Motivation to Accomplish (IMA)	.97
Intrinsic Motivation to Stimulation (IMS)	.92

Table 3: Internal consistency values (Cronbach's alpha) of AMS's 7 subscales

Analysis of the quantitative data occurred primarily through descriptive statistics as shown in Table 4. As mentioned, the values on the AMS-C 28 subscales ranged from 1 *(Does not correspond at all) to* 7 *(Corresponds exactly).* The most corresponding motivation subtypes were the three intrinsic types: to know, to accomplish, and to experience stimulation. Doctoral students agreed with subscale items such as earning the degree because of the satisfaction felt when accomplishing difficult academic activities, because of the feeling experienced when communicating their ideas with others, and because of the pleasure felt while learning new things. Students were not disinterested nor passive about earning a Ph.D. as indicated by the low mean (M = 1.41) on items on the Amotivation subscale. Students agreed a little with items on the external regulation subscale, which represented extrinsically motivating factors such as earning a Ph.D. because it may lead to a high-paying or prestigious job. This low score indicates these participants were less motivated by external factors that one might experience upon completion of a doctoral degree. There was moderate correspondence for the introjected regulation (M = 4.36, SD = 2.05) subtype indicating that participants were somewhat motivated to earn the degree to prove their intelligence. The mean score of 3.84 (SD = 1.62) for the identified regulation subscale signified that students deemed the degree valuable to their career preparation, though not in the same monetary way as with the items that represented external regulation.

Motivation subtype	**Mean**	**Standard Deviation**	**Min**	**Max**
Amotivation	1.41	0.84	1	3.25
External Regulation	2.71	1.67	1	5
Identified Regulation	3.84	1.62	1.5	6
Introjected Regulation	4.36	2.05	1.25	7
Intrinsic Motivation to Stimulation	5.07	1.87	1.75	7
Intrinsic Motivation to Accomplish	5.57	2.03	1.25	7
Intrinsic Motivation to Know	6.52	0.79	5.25	7

Table 4: Mean levels, standard deviation, and ranges of motivation subtypes

Administering the survey served to lend objectivity to the research in keeping with the researcher's somewhat post-positivism leanings (Hands 2018), however, survey results alone were not expected to impart rich, descriptive detail on the phenomenon of doctoral student motivation. Thus, qualitative data were generated

from two sources: semi-structured interviews and personal admission statements. The semi-structured interview format, with its mostly open-ended questions written in advance in an interview protocol (Brinkmann and Kvale 2015), was selected because its flexibility allowed for responding "to the situation at hand, to the emerging worldview of the respondent, and to new ideas on the topic" (Merriam 2009, 90). In this manner, the researcher and participant co-constructed an understanding of the phenomenon under study through follow-up questions and clarification as the interview progressed. Interviews were digitally recorded and subsequently manually transcribed verbatim by the researcher. To preserve the authenticity of the conversations, instances of disfluent speech (e.g., pauses, partial words, and restarts) by the interviewer and participants were not corrected (Rosenfelder et al. 2011). Additional transcript cleaning included removing names of institutions and other identifying information to ensure anonymity; attribute codes were assigned based on participant characteristics (Saldaña 2016).

Personal admission statements, a unique choice of data source, were expected to provide additional understanding of participants' motivation for earning a doctoral program. In personal admission statements – an admissions requirement of many doctoral programs – applicants discuss their research interests and how they align with program faculty, educational background, professional experience, and career goals as related to their chosen research area; sometimes applicants discuss their motivation for applying to the program. While data generated from the statements were expected to supplement data from the interviews and the AMS-C 28 results, the researcher also was open to the possibility of information from personal admission statements diverging from the other data. The two sources of qualitative data, admittedly, had different initial purposes (Farmer et al. 2006): the interviews with questions designed to elicit responses specific to an a priori research question versus personal admission statements wherein motivational factors may not have been an explicit aim as students were addressing questions set forth by their respective institutions. Still, some motivational factors could be ascertained from the admissions statements. The use of personal admission statements presented a methodological contribution to existing literature; to the researcher's knowledge, this data source had not been used in studies examining doctoral student motivation.

The personal admissions statements and participant interviews were subjected to inductive qualitative content analysis using a constant comparative method to identify codes and then themes addressing the research question (Corbin and Strauss 2015). As with coding practices for qualitative data, codes from each data set were subjected to first- and second-cycle coding (Saldaña 2021) to produce a final unified list of themes representing the motivating factors for earning a Ph.D. As shown in Figure 2, the unified list of motivating factors contained seven main themes with fifteen subthemes.

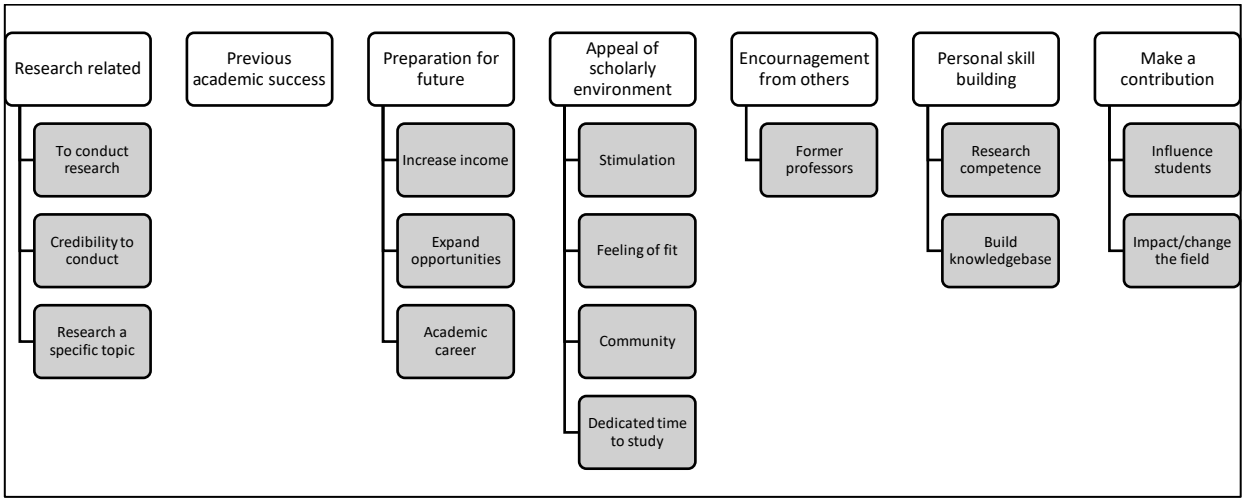

Figure 2: Unified list of motivating themes and subthemes from qualitative data

Several processes were applied to establish the trustworthiness of the qualitative data (Lincoln and Guba 2013). The researcher conducted a peer debriefing session with research colleagues wherein the analytic process was introduced, the codebook and coding scheme were demonstrated, and emerging categories of motivating factors were discussed and modified. Rich, thick descriptions of participants and their contexts were created provided so that readers could assess the transferability of the findings. Lastly, the author's biases were acknowledged and clarified throughout the study.

An illustration of mixed methods integration by comparison

Having generated findings from the qualitative and quantitative data sources, the researcher set out to integrate the findings for an aggregate picture of doctoral student motivation. Table 5 summarizes the key findings from the qualitative and quantitative data that will be integrated. The process involved integrating the seven motivating factors or themes as identified in the qualitative data and the individual items of the Academic Motivation Scale that represented the four motivation subtypes with moderate and definite correspondence for participants – introjected regulation and the three intrinsic motivation types. The researcher used the individual scale items rather than the composite motivation subtypes because the scale items provided more nuance than the overarching motivation subtype categories.

Qualitative data for integration	Quantitative data for integration
7 motivating factors generated from interviews and personal admission statement	16 items from the AMS-C 28 representing introjected regulation and intrinsic regulation

Table 5: Summary of data to integrate

Integration aimed to generate an aggregate account of doctoral student motivation based on points of convergence and divergence. It also was important to identify points of divergence to acknowledge the inherent messiness of mixed methods research where triangulating, merging, or mixing of qualitative and quantitative data

may produce complementary or contrasting results. Here, as expressed by Sanscartier (2020, 48), the researcher pushes against "epistemological norms [which] pressure researchers to present unified, singular views of reality." Noting instances of divergence identified during integration makes a methodological contribution as few articles disclosing divergent findings exist in the literature (Pluye et al. 2009), perhaps due to publication bias.

Integration occurred in the interpretation stage using a mixed methods matrix (O'Cathain, Murphy and Nicholl 2010; Heselhurst et al. 2015) to portray doctoral student motivational factors. The matrix or convergence table, shown in Table 6, notes instances of agreement and disagreement between the qualitative results and quantitative findings. To create the table, the author started with the quantitative data: the 16 items representing the four most corresponding motivation subscales were listed in a left-side column. Researchers using a similar integration process may choose to begin the comparison with the qualitative data. Deductive analysis was then applied for the 7 qualitative themes using the subscale items as specific experiences of examination (Saldaña 2021). That is, each qualitative theme was compared to the specific experiences as described in the subscale items.

Memos generated during the initial analysis of qualitative data and related to the themes aided in comparing the theme to the subscale item. Notes were made when a connection between the subscale item and the theme was uncovered; the notes helped determine the applicable data convergence label – present, absent, or mixed (Fitzpatrick 2016). This process of comparing subscale item to theme continued for each quantitative item. If a connection between quantitative subscale item and qualitative theme was noted, the connection was further analyzed for assignment of a data convergence label. *Present*, reflected twice in the convergence table, refers to a shared meaning between the two data elements, i.e., the elements are present and share the same meaning in both sets of data. *Absent*, occurring seven times on the convergence table, indicates the instance described in the subscale item did not bear out in the qualitative data. *Mixed*, reflected seven times in the convergence table, refers to motivational factors that are present in both data sets, though with different meanings – colloquially speaking, the same but different. For example, the qualitative and quantitative data both pointed to participants wanting to prove or show that they could succeed as a researcher by earning a doctoral degree. However, the subscale item pertained to proving to oneself whereas in the qualitative data earning the degree served to prove one's research abilities to others.

Quantitative Motivation Subscale Item	**Qualitative Theme**	**Convergence Type**
Because I experience pleasure and satisfaction while learning new things. (IMK)	Personal skill-building	Mixed
For the pleasure I experience when I discover new things never seen before. (IMK)	Absent	
For the pleasure that I experience in broadening my knowledge about subjects which appeal to me. (IMK)	Personal skill-building; research-related reasons	Present

Because my studies allow me to continue to learn about many things that interest me. (IMK)	Personal skill-building	Present
For the pleasure I experience while surpassing myself in my studies. (IMA)	Absent	
For the pleasure that I experience while I am surpassing myself in one of my personal accomplishments. (IMA)	Absent	
For the satisfaction I feel when I am in the process of accomplishing difficult academic activities. (IMA)	Past academic success	Mixed
Because a doctoral program allows me to experience a personal satisfaction in my quest for excellence in my studies. (IMA)	Absent	
For the intense feelings I experience when I am communicating my own ideas to others. (IMS)	Appeal of the scholarly environment	Mixed
For the pleasure that I experience when I read interesting authors. (IMS)	Personal skill-building	Mixed
For the pleasure that I experience when I feel completely absorbed by what certain authors have written. (IMS)	Absent	
For the "high" feeling that I experience while reading about various interesting subjects. (IMS)	Personal skill-building; the appeal of the scholarly environment	Mixed
To prove to myself that I am capable of completing my doctoral degree. (INTRO)	Absent	
Because of the fact that when I succeed in a doctoral program I feel important. (INTRO)	Absent	
To show myself that I am an intelligent person. (INTRO)	Preparation for the future; research-related reasons	Mixed
Because I want to show myself that I can succeed in my studies. (INTRO)	Preparation for the future; research-related reasons	Mixed

Table 6: Data convergence table integrating two data sets

Many labels can be applied in a convergence table. The data labels selected were intended to describe the relationship between the two data sets as related to the phenomenon in this case; other researchers may use data labels more applicable to their research. Fitzpatrick (2016) used the terms: *confirm*, *contradict*, *enhance*, and *mixed*. Heselhurst et al. (2015) indicated instances of agreement and disagreement using the terms: *convergence*, *complementarity*, *dissonance*, and *silence*. Using the data labels *present*, *absent*, and *mixed*, allowed me to stay close to the relationship between the two data sets and the overall aim of inquiry. In interpreting the data sets, it was clear that findings from the qualitative data did not necessarily contradict the

results of the quantitative data, rather the essence of the subscale item was not identified or presented to the same extent (was absent or mixed) in the qualitative data.

According to the quantitative data, participants corresponded "a lot" with items related to the intrinsic motivation subscales. Integrating the subscale items with the qualitative motivating themes, however, revealed a mix of agreement as noted by the application of all three data labels under 'Convergence Type' in Table 6. Absence or mixed convergence between the qualitative and quantitative data may be attributed to the difference in the focus of the data sets. The items on the AMS-C 28 are very specific in wording, more so than the distilled qualitative motivating factors and more pointed than the interview questions. For example, the *intrinsic motivation to accomplish* (IMA) subscale corresponded "a lot" for participants as indicated by the mean score of 5.57 in Table 4. Yet, pursuing the doctoral degree as a sign of accomplishment or to exceed personal academic goals, as presented on the instrument (see table 6), was not conveyed in the qualitative data. Though positive experiences in higher education motivated participants to earn the degree, they were not necessarily on a quest for academic excellence or to meet an academic challenge as depicted in the subscale items. Similarly, for the quantitative items on the *intrinsic motivation to know* subscale, participants were interested in broadening their existing knowledge base, so it may be assumed they would derive pleasure in so doing.

Items on the intrinsic motivation to stimulation (IMS) subscale pertained to the experience of scholarly engagement primarily through reading. Participants in the present study were motivated by the appeal of scholarly environments as experienced through the social aspects of research, such as communicating their research to others and engaging in scholarly discourse with fellow researchers but spoke less (and were not asked) about being stimulated by reading authors. Thus, the *mixed* and *absent* labels on related subscale items. The researcher may be applying a strict interpretation of the subscale items related to reading authors in the field as it may be assumed that participants enjoyed reading prominent authors to expand their knowledge base of the field but may not describe the experience as "intense."

Items on the introjected regulation (INTRO) subscale referred to feelings of self-efficacy and self-concept and behaviors performed to avoid guilt or anxiety. In this sense, individuals act to "demonstrate ability (or avoid failure) in order to maintain feelings of worth" (Ryan and Deci 2000, 72). Participants indicated moderate correspondence with introjected regulation subscale items. In the interviews, one participant reported that the degree was a necessary credential to prove herself capable of conducting research. This reason was connected under the research-related reasons and preparation for the future motivating themes in the qualitative data and represented as a mixed when integrated with the quantitative data because the intent was to show others her competence and capabilities.

Discussion

As illustrated in this example, attempting to provide a full account of a phenomenon – doctoral student motivation – does not mean it will be one in which the findings corroborate each other. Using qualitative and quantitative data sets may result

in mixed, converging, or diverging results. Transparency in research includes acknowledging the potential for divergent findings as shown in this case. Mixed or divergent findings may be indicative of gradations or nuances of the phenomenon under study. Divergence may also appear because of the purpose of each data-gathering method (Farmer et al. 2006). For instance, though both the interviews and AMS-C 28 led with a similar question, interviews allowed for free-flowing conversation not possible when addressing specific items on an instrument. The interviews were designed to elicit richly detailed, less filtered responses from participants specifically related to the research question. Personal admission statements, on the other hand, have a different intent including to learn more about applicants' research interests and abilities, possibly explaining the presence of research-related reasons in both qualitative data sets.

Each type of data proved to be insightful in different ways. Admittedly, insight gleaned from the personal admission statement was dependent upon the writing prompt on the admissions application, which varied by institution. Unlike the personal admission statements, the AMS-C 28 and interviews directly related to students' motivational factors for earning the doctoral degree. Information from the interview shed light on persons who were influential to a student considering a doctoral program; this level of detail could not have been obtained through the AMS-C 28. Also, in an interview, the researcher could probe for clarification, a data-gathering technique not possible in an online survey. Further, in keeping with constructivism, qualitative data served to provide context for the knowledge generated, more than could be gleaned from the quantitative data. Qualitative data, especially the semi-structured interviews, also proved to satisfy ontological authenticity whereby participants experienced moments of clarity becoming "aware of constructions that they did not realize they held until the inquiry brought them from the tacit to the propositional level" (Lincoln and Guba 2013, 70).

The survey instrument, AMS-C 28, focused on rather affective reactions to the doctoral experience and reasons to earn the doctoral degree. Items may have been phrased too strongly such that individuals may feel deeply about learning new things or interacting in scholarly environments but may not categorize those experiences using terms like "pleasure", "high," or "intense" feelings as expressed in the survey. In this regard, the qualitative data may have offered a more authentic account of students' motivation. A future mixed methods study might use the AMS-C 28 responses as the basis for follow-up interviews with participants.

Some challenges to integrating qualitative and quantitative data sets must be noted. Consistent with the literature that examined barriers to integration among social scientists (Bryman 2007), this researcher encountered challenges due to the lack of concrete exemplars demonstrating integration. Another challenge encountered during this work was deciding on the focus of the quantitative data for interpretation. That is, whether to focus integration and analysis on the motivation subtype categories as a whole or the individual items representing each motivation subtype upon which the mean scores were based, and which were presented to participants. It was decided to use the individual scale items because, though meant to serve as representatives of the

motivation subtypes, they provided richer detail for comparison with the qualitative motivating factors.

As opposed to presenting the results individually, as in Table 4 and Figure 2, leaving the reader to intuit points of integration, presenting the integration as a convergence table served to succinctly convey the connection (present, absent, or mixed) between qualitative and quantitative findings as noted in the Convergence Type column and the point of connection as indicated in the Qualitative Theme column. Integration via a convergence table facilitated a structured comparison of qualitative and quantitative data moving back and forth between subscale items and individual qualitative themes to tease out the presence and type of connection. Lastly, the integration process allowed for some moderating of the data to present a more nuanced portrait of doctoral student motivation.

Conclusion

The focus of this article was to illustrate one approach to integrating qualitative and quantitative data in a mixed methods study. Examining LIS doctoral student motivation using a mixed methods approach led to complementary and mixed insights. The integrated results suggest that doctoral students are motivated by an enjoyment of learning new things related to their interests that align with their desire for personal skill-building and to conduct research; by past academic success, which instills confidence that they can continue to succeed in challenging academic activities such as doctoral studies; by the enjoyment of scholarly environments where they can share ideas with others and build skills by learning from others at conferences; and because the degree supports their future goals while also serving as an indicator to others of their intelligence, skills, and abilities. Such heterogeneity of results highlights the complexity of the decision-making process and variances that may not be considered by faculty or program administrators. Differing motivational factors as brought forth by qualitative and quantitative data point to the diverse appeal of doctoral studies. The research presented here lays the groundwork for further doctoral student-centered research within library and information science, and future research on this topic should include larger samples of participants.

The lack of integration examples in mixed methods research has been well documented (Bryman 2007; Farmer et al. 2006; O'Cathain, Murphy, and Nicholl 2010). As more mixed methods studies appear in LIS literature, researchers are encouraged to include explicit examples of integration to contribute to the methodological canon. The example presented here aimed to contribute a transparent example of mixed methods integration from a LIS-related study. Utilizing a convergence table is but one of several integration techniques that may be employed in mixed methods research. The illustration and its mix of *present*, *absent*, and *mixed* connections highlight the complicated messiness of the mixed methods approach, which may deter researchers from either employing the approach or fully explicating one's integration techniques (Sanscartier 2020). In this case, applying a mixed methods approach resulted in a

broader answer to the research question and provided possible avenues for further examination beyond this exploratory study.

Acknowledgements

The author expresses gratitude to the anonymous reviewers for their valuable feedback.

About the author

Africa S. Hands is assistant professor of library science at East Carolina University. Her research focuses on library services to historically marginalized communities, first-generation students and professionals, and LIS education. She is the author of Successfully Serving the College Bound (ALA Editions 2015) and her work has been published in the *Journal for Education of Library and Information Science*, *Education for Information*, and *Information and Learning Sciences.* She holds a PhD in information systems from Queensland University of Technology and an MLIS from San José State University.

References

Beck, Mark. 2016. "Examining Doctoral Attrition: A Self-Determination Theory Approach." *The Nebraska Educator: A Student-led Journal* 33: 5-19. https://doi.org/10.13014/K2JW8BSG.

Brinkmann, Svend and Steinar Kvale, eds. 2015. *InterViews: Learning the Craft of Qualitative Research Interviewing.* Thousand Oaks: SAGE Publications, Inc.

Bryman, Alan. 2006. "Integrating Quantitative and Qualitative Research: How Is It Done?" *Qualitative Research* 6 (1): 97-113. https://doi.org/10.1177/1468794106058877.

Bryman, Alan. 2007. "Barriers to Integrating Quantitative and Qualitative Research." *Journal of Mixed Methods Research* 1 (1): 8-22. https://doi.org/10.1177/2345678906290531.

Cardona, Julio. 2013. "Determined to Succeed: Motivation Towards Doctoral Degree Completion." Ph.D. diss., University of Michigan. https://hdl.handle.net/2027.42/99774.

Chu, Heting. 2015. "Research methods in library and information science: A content analysis." *Library & Information Science Research* 37 (1): 36-41. https://doi.org/10.1016/j.lisr.2014.09.003.

Corbin, Juliet M. and Anselm Strauss, eds. 2015. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory.* Thousand Oaks, CA: Sage Publications, Inc.

Creamer, Elizabeth. 2017. *An Introduction to Fully Integrated Mixed Methods Research.* Thousand Oaks, CA: SAGE Publications, Inc.

Creswell, John W. 2014. *Research Design: Qualitative, quantitative, and Mixed Methods Approaches.* Thousand Oaks, CA: SAGE Publications, Inc.

Creswell, John W., and Vicki L. Plano Clark. 2007. *Designing and Conducting Mixed Methods Research*. Thousand Oaks, CA: SAGE Publications, Inc.
Creswell, John W., and Vicki L. Plano Clark. 2011. *Designing and Conducting Mixed Methods Research*. Thousand Oaks, CA: SAGE Publications, Inc.
Creswell, John W., and Vicki L. Plano Clark. 2018. *Designing and Conducting Mixed Methods Research.* Thousand Oaks, CA: SAGE Publications, Inc.
Crist, Emily, and Elizabeth Berman. 2016. "Mixed Methods Research in LIS Literature: A Scoping Review." https://scholarworks.uvm.edu/libfacpub/39.
Deci, Edward L., and Richard M. Ryan. 1985. *Intrinsic Motivation and Self-Determination in Human Behavior*. New York: Plenum Press.
Deci, Edward L., and Richard M. Ryan. 2002. *Handbook of Self-Determination Research*. Rochester, NY: University of Rochester Press.
Ellingson, R. 2009. *Engaging in Crystallization in Qualitative Research.* Thousand Oaks, CA: SAGE Publications, Inc.
Farmer, Tracy, Kerry Robinson, Susan J. Elliott, and John Eyles. 2006. "Developing and Implementing a Triangulation Protocol for Qualitative Health Research." *Qualitative Health Research* 16 (3): 377-394. https://doi.org/10.1177/1049732305285708.
Fetters, Michael, and José F. Molina-Azorin. 2017. "The *Journal of Mixed Methods Research* starts a new decade: The mixed methods research integration trilogy and its dimensions." *Journal of Mixed Methods Research* 11 (3): 291-307, https://doi.org/10.1177/1558689817714066.
Fidel, Raya. 2008. "Are We There Yet? Mixed Methods Research in Library and Information Science." *Library & Information Science Research* 30: 265-272. https://doi.org/10.1016/j.lisr.2008.04.001.
Fitzpatrick, Kate. 2016. "Points of Convergence in Music Education: The Use of Data Labels as a Strategy for Mixed Methods Integration." *Journal of Mixed Methods Research* 10 (3): 273-291.
Granikov, Vera, Quan N. Hong, Emily Crist, and Pierre Pluye. 2020. "Mixed Methods Research in Library and Information Science: A Methodological Review." *Library and Information Science Research* 42 (1), https://doi.org/10.1016/j.lisr.2020.101003.
Hands, Africa. 2018. "LIS Doctoral Student Motivation: An Exploratory Study of Motivating Factors for Earning the PhD." PhD diss., Queensland University of Technology. https://doi.org/10.5204/thesis.eprints.120828.
Hegarty, Niall. 2010. "Application of the Academic Motivation Scale to Graduate School Students." *The Journal of Human Resource and Adult Learning* 6 (2): 48-55. http://www.hraljournal.com/Page/6%20Niall%20Hegarty.pdf.
Heselhurst, Nicola, Sarah Dinsdale, Gillian Sedgewick, Helen Simpson, Seema Sen, Carolyn Dawn Summerbell and Judith Rankin. 2015. "An Evaluation of the Implementation of Maternal Obesity Pathways of Care: A Mixed Methods Study with Data Integration." *PLoS One* 10 (5): 1-34. https://doi.org/10.1371/journal.pone.0127122.

Julien, Heidi, and Christine Fena. 2018. "Thirty-One Years of Canadian Journal of Information and Library Science: A Content Analysis." *Canadian Journal of Information and Library Science* 42 (1-2): 1-17. https://doi.org/10.29173/cais983.

Johnson, Rebecca, Amy L. Grove, and Aileen Clarke. 2017. "Pillar Integration Process: A Joint Display Technique to Integrate Data in Mixed Methods Research." *Journal of Mixed Methods Research* 13 (3): 301-320. https://doi.org/10.1177%2F1558689817743108.

Johnson, R. Burke, Anthony Onwuegbuzie and Lisa A. Turner. 2007. "Toward a Definition of Mixed Methods Research." *Journal of Mixed Methods Research* 1 (2): 112-133. https://doi.org/10.1177%2F1558689806298224.

Kemp, Matthew W., Timothy J. Molloy, Marina Pajic and Elaine Chapman. 2014. "An Analysis of Reported Motivational Orientation in Students Undertaking Doctoral Studies in the Biomedical Sciences." *BMC Medical Education* 14 (38): 1-11. https://doi.org/10.1186/1472-6920-14-38.

Lincoln, Yvonna, and Egon Guba. 2013. *The Constructivist Credo.* Walnut Creek, CA: Left Coast Press, Inc.

Maxwell, Joseph, and Diane Loomis. 2003. "Mixed Methods Design: An Alternative Approach." In *Handbook of Mixed Methods in Social and Behavioral Research*, edited by Abbas Tashakkori and Charles Teddlie, 241-272. Thousand Oaks, CA: SAGE Publications, Inc.

McCarthy, Grace. 2016. "Appling Self-Determination Theory to Improve Completion Rates in a Part-Time Professional Doctoral Program." In *Emerging Directions in Doctoral Education: Innovations in Higher Education Teaching and Learning,* edited by Patrick Blessinger and Denise Stockley, 207-223. Bradford, UK: Emerald.

Merriam, Sharan. 2009. *Qualitative Research and Case Study Applications in Education.* San Francisco: Jossey-Bass Publishers.

Moran-Ellis, Jo, Victoria D. Alexander, Ann Cronin, Mary Dickinson, Jane Fielding, Judith Sleney, and Hilary Thomas. 2006. "Triangulation and Integration: Processes, Claims and Implications." *Qualitative Research* 6 (1): 45-59. https://doi.org/10.1177%2F1468794106058870.

Morgan, David L. 2007. "Paradigms Lost and Pragmatism Regained: Methodological Implications of Combining Qualitative and Quantitative Methods." *Journal of Mixed Methods Research* 1 (1): 48-76. https://doi.org/10.1177%2F2345678906292462.

Morgan, David L. 2014. *Integrating Qualitative and Quantitative Methods: A Pragmatic Approach.* Thousand Oaks, CA: SAGE Publications, Inc.

Mosyjowski, Erika A., Shanna R. Daly, and Diane L. Peters. 2017. "Drivers of Research Topic Selection for Engineering Doctoral Students." *International Journal of Engineering Education* 33 (4): 1283-1296. http://dalyresearch.engin.umich.edu/wp-content/uploads/sites/237/2018/02/Drivers-of-research-topic-selection-for-engineering-doctoral-students.pdf.

O'Cathain, Alicia, Elizabeth Murphy, and Jon Nicholl. 2010. "Three Techniques for Integrating Data in Mixed Methods Studies." *British Medical Journal* 341: 1147-1150. https://doi.org/10.1136/bmj.c4587.

Petrelli, Heather. 2014. "Predictors of Academic Motivation in Pharmacy School Applicants." Ph.D. diss., Barry University. https://www.proquest.com/docview/1533541070/abstract/472CC7CACCD14B93PQ/1.

Plano Clark, V. 2019. "Meaningful Integration Within Mixed Methods Studies: Identifying Why, What, When, and How." *Contemporary Educational Psychology* 57: 106-111. https://doi.org/10.1016/j.cedpsych.2019.01.007.

Pluye, Pierre, Roland Grad, Alissa Levine, and Belinda Nicolau. 2009. "Understanding Divergence of Quantitative and Qualitative Data (Or Results) in Mixed Methods Studies." *International Journal of Multiple Research Approaches* 3: 58-72. https://doi.org/10.5172/mra.455.3.1.58.

Rosenfelder, Ingrid, Josef Fruehwald, Keelan Evanini and Jiahong Yuan. 2011. "Automatic Alignment and Analysis of Linguistic Change - Transcription Guidelines." http://fave.ling.upenn.edu.

Ryan, Richard, and Edward Deci. 2000. "Self-Determination Theory and the Facilitation oIntrinsic Motivation, Social Development, and Well-Being." *American Psychologist* 55 (1): 68-78. https://doi.org/10.1037/0003-066X.55.1.68.

Ryan, Richard, and Edward Deci. 2017. *Self-Determination Theory: Basic Psychological Needs in Motivation, Development, And Wellness.* New York: Guilford Press.

Sanscartier, Matthew. 2020. "The Craft Attitude: Navigating Mess in Mixed Methods Research." *Journal of Mixed Methods Research* 14 (1): 47-62. https://doi.org/10.1177%2F1558689818816248.

Saldaña, Johnny. 2016. *The Coding Manual for Qualitative Researchers* (3rd ed.). Thousand Oaks, CA: SAGE Publications Inc.

Saldaña, Johnny. 2021. *The Coding Manual for Qualitative Researchers* (4th ed.). Thousand Oaks, CA: SAGE Publications Inc.

Tavakol, Mohsen and Reg Dennick. 2011. "Making Sense of Cronbach's Alpha." *International Journal of Medical Education* 2: 53-55. https://doi.org/10.5116%2Fijme.4dfb.8dfd.

Vallerand, Robert J., Luc G. Pelletier, Marc R. Blais, Nathalie M. Brière, Caroline Senécal and Evelyne F. Vallieres. 1992. "The Academic Motivation Scale: A Measure of Intrinsic, Extrinsic, and Amotivation in Education." *Educational and Psychological Measurement,* 52: 1003-1017. https://doi.org/10.1177%2F0013164492052004025.