Issues to Consider for Online Doctoral Candidates Utilizing Meta-Analysis for Dissertations

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Achieving a doctoral degree is an honor that comes with significant investment and risk. Researchers have collectively revealed that an alarming one in every two doctoral candidates will fail to complete their degree (Baltes & Brown, 2018; Di Pierro, 2012; Grasso, Barry, & Valentine, 2009; Marshall, Klocko, & Davidson, 2017; Pitchforth et al., 2012). Even more concerning are the findings that the attrition rate could be higher for online students, with up to 60% non-continuation rates (Baltes & Brown, 2018; Spaulding & Rockinson-Szapkiw, 2012).

Various reasons were proposed to explain the national estimated 50% attrition rate of doctoral students, which remains persistent (Baltes & Brown, 2018; Golde, 2005). According to Golde (2005), factors such as economic cost, level of university support, peer support, environmental issues, and challenges related to the dissertation process can contribute to the doctoral students' alarming attrition rate. Other researchers (Baltes & Brown, 2018; Lovitts, 2008) have concurred and emphasized that a critical element to doctoral students' non-completion is correlated to challenges during the dissertation process. Specifically, Baltes and Brown (2018) collected data on a large number of doctoral students and found that 40% or more students failed to complete their degree requirements due to incomplete dissertations. Lack of early faculty feedback (Bates & Brown, 2018) and social isolation (Jairam & Kahl, 2012) are significant reasons reported for not completing the dissertation.

Muszynski (1988) conducted a comparison of graduate students who were 'delayed' in completing their dissertations and those who were 'timely' with completion. The study found that students who lived farther from campus were more likely to be delayed. Having less access to needed advisors, faculty, peer s, and on-campus resources for dissertations would likely be a large part of this difficulty. This lack of access was confirmed by the findings that clinical psychology students who took longer to complete their dissertation reported that due to living further away from campus, they had limited access to the support of advisors, faculty, peer community, and on-campus resources resulting in delays (Muszynski, 1988).

Researchers agree that completion of the dissertation process is the hallmark in doctoral students obtaining their degrees (Barnes, Williams, & Stassen, 2012; Marshall et al., 2017; Spillet & Moisiewicz, 2004). Mentorship by faculty and chairperson plays a valuable role for students' realistic choice of research method, efficiency, and even social and emotional support, which can lead to timely dissertation completions (Barnes et al., 2012; Marshall et al., 2017). The chairperson interchangeably serves as leader, supervisor, advocate, and judge to their students based on the situation and needs of the student. However, most notably, Isaac, Quinlan, and Walker (1992) added that the chairperson acts as the 'gatekeepers,' controlling access to doctoral degrees. This is one of the most essential roles bestowed upon dissertation chairs. However, that responsibility also carries with it the opposite responsibility of ensuring that realistic steps are in place for dissertation completion and students' research preparedness.

Solutions and support for doctoral students' completion were examined by the Strategic Intervention for Doctoral Completion project, which found four ways to improve doctoral completion (Council of Graduate Schools, 2007). The Council of Graduate Schools (2007) recommended finding the right fit of students who understands and is prepared for the rigors of a doctoral program and accepting only those students. Next, the Council encouraged peer support and cultivating faculty and mentorship relationships needed for successful completion.

Considering the higher attrition rate of online students (Baltes & Brown, 2018), there remains a gap in empirical research that provides specific solutions to help improve online doctoral candidates' completion. As noted in Muszynski's (1988) study, students who lived farther from campus were more likely delayed in their research work and had less access to the needed resources for dissertations. Similarly, online doctoral students may encounter limited resources related to their dissertation project, which may require advanced mentorship from their chair to work around these limitations. For example, an underlying psychological research experiment underscores what obstacles await the doctoral student working on a dissertation. Finding sufficient subjects for the study's needed 'power' is one of the most prominent obstacles (Stebleton & Soria, 2012). Also, online doctoral students are faced with the dilemma of finding willing individuals to participate and disclose information, create measures needed for relevant data collection along with finding appropriate equipment and facilities (i.e., laboratory) for data collection.

In a study of online doctoral students, Kumar, Johnson, and Hardeman (2013) found some limitations of these online doctoral students to be more prominent compared to students in traditional settings. This includes difficulties with lack of "access to resources for research and professional development" (p. 298). Students involved in this qualitative study also reported that online mentoring led to more difficulties with "withdrawal of participants" and how to handle that sort of withdrawal compared to mentoring in more traditional settings. These difficulties would particularly impact doctoral students in the social sciences and education (Kumar et al., 2013).

Doctoral online students having less access to the tangible resources compared to doctoral students in more traditional settings is likely the result of how research, particularly social science research, has been conducted for decades (Kumar et al., 2013). Students who are in traditional settings would have more access to the resources that have made up the bulk of social science research in the United States and much of the industrialized world. In 2010, Henrich, Heine and Norensayan penned their famous article "The Weirdest People in the World" addressing how much of social science research focuses on the "WEIRD" (Western, Educated, Industrialized, Rich and Democratic) population and how a significant reason for this is the emphasis on undergraduate students as research subjects. Henrich et al. (2010) found that 68% of subjects in social science research studies came from the United States and 67% of those subjects were students at traditional American universities and colleges. Subsequent studies have also found that research findings strongly emphasize undergraduate students in traditional settings as subjects (Anderson et al., 2019; Rad, Martingano, & Ginges, 2018). Although these articles did not specifically reference dissertation studies, it would not be unreasonable to conclude that students in traditional settings would likely benefit from being this high volume of social science research and that online students would largely miss out on that benefit.

There is a need for dissertation chairs and committee members to explore with online students applicable approaches that will be realistic to successful completion of their dissertations. This involves addressing challenges of dissertation research, which is always a complicated endeavor; in ways that take into account the specific situations faced by students looking to complete their doctoral work online. This article will look at one specific approach to dissertation research that can fit very well for online doctoral students. It allows for students to look at different research questions in ways that fit into circumstances faced by many online students. Specifically, this article will look at the use of meta-analyses in dissertation research and how this approach

might present a solution to the high attrition rate among online doctoral candidates.

Literature Review

According to Abdullah (2018), meta-analysis allows for as much opportunity to 'create a research niche' as do other types of research. Meta-analysis provides opportunities for researchers, including doctoral students completing dissertations, to conduct a structured and formal examination at what the findings of multiple research studies indicate about significant research questions. What is particularly valuable about the use of these methods for online doctoral candidates is that it provides the opportunity to add new empirical data to the field when there may be limited resources available to students.

Quintana (2015) provided a primer for conducting a meta-analysis. This author defined meta-analysis as a "statistical integration of evidence from multiple studies that address a common research question" (p.1549). This meta-analysis involves a process whereby effect sizes and measures from numerous research studies are combined to compute a single adequate size across those studies. This approach helps provide an interpretation of what common conclusions can be drawn from the studies taken together and also provides direction for future research.

It is worthwhile at this point to address why meta-analysis fits particularly well for online doctoral students. Addressing the need for finding "numerous research studies" might seem at odds with the limitations outlined earlier that online students face. When considering those limitations it is useful to keep in mind that these limitations relate to the physical resources needed for conducting research studies. The research outlined earlier in this paper revealed that much of the research conducted in the United States, and other developed countries, is being conducted on college and university campuses (Anderson et al., 2019; Rad, Martingano, & Ginges, 2018). It would follow then that students physically on those campuses would have more access to the resources used for that research, primarily if the faculty members conducting the research are serving on their committees. This is, of course, not a criticism of that research but is merely an identification of facts regarding resource availability.

However, online doctoral students are not more limited than traditional students in all areas of resource availability for research. Even if they do have less access to potential subjects, equipment, faculty availability and physical space needed for research, they would have no less access to library materials and computer programs. That is, of course, because those are resources that can be made available online and do not require the student to be any particular physical space to use them. Colleges and universities have most, if not all, of their holdings available to students online, and every research journal can be accessed online. Also, computer programs can be accessed where students use computers. Since, as we will see, meta-analyses rely primarily on access to research studies and statistical computer programs, they are particularly well-suited for students conducting their dissertation research for online programs.

Benefits of Using Meta-Analysis by Online Doctoral Candidates

Using meta-analyses is beneficial when examining the performance differences between groups, and it provides objective findings based on the use of mathematical calculations (Sjoberg,

2014). Based on its transparent and objective findings, meta-analyses are often useful when proposing studies for clinical practice, health policies, and grant seeking for research studies (Quintana, 2015).

A meta-analysis also encourages the development of independent study and critique, as it does not need as much faculty guidance once students are familiar with the meta-analysis procedures. This article will review the main steps of that process and will show that it is very involved but rather straightforward. Once students are familiar with the necessary steps, they can likely follow through on these steps independently and not need as much faculty support as might be needed for other types of research.

Easy Access to Research Databases. Meta-analysis use will positively impact online doctoral candidates since they can easily access online libraries with similar databases as 'brick-and-mortar' universities. For example, a meta-analysis starts with a thorough literature review. Appropriate keywords and search limits are identified and used to find literature that will be incorporated in the meta-analysis. These keywords and search terms are then put into appropriate databases (e.g., PubMed and PsychInfo) that are typically available through university libraries (Sjoberg, 2014).

Networking Opportunities. As noted by Sjoberg (2014), there may be times when access to specific articles is limited, but the way around this challenge may, in fact, be beneficial, especially to online students. For example, a student can contact the authors directly to describe their dissertation and request copies of the authors' studies. Subsequently, this part of the process could serve as a prime networking catalyst for the student with other researchers in the field. Establishing these networking opportunities is useful in anchoring the student to their dissertation and creating a professional identity for future collaborations (De Solla Price, & Beaver, 1966).

Subsequently, Dominguez (2006) noted that external elements beyond peer, family, and small group support had been linked to graduate students' success and graduation completion. Supervisory and institutional networking was identified as beneficial elements. Krueger and Peek (2006) found that having interpersonal relationships during the dissertation process was valuable in developing skills needed for academic research, writing, and publishing.

In summary, this article examines the main steps students need for completing a meta-analysis as well as the significant criticisms of meta-analyses and responses students can provide to those criticisms. Referenced empirical meta-analyses sources for students' reviews are provided. These resources serve as a practical guide for online doctoral candidate students to consider for dissertation topics.

Conducting a Meta-Analysis

Meta-analysis has been adequately defined as a "statistical integration of evidence from multiple studies that address a common research question" (Quintana, 2015). It involves a process whereby effect sizes from numerous research studies are combined to compute a single effect size across the studies (Cheung, Ho, Lim & Mak, 2012). This approach then allows for interpretation

of what common conclusions can be drawn from the studies taken together and also provides direction for future research.

A meta-analysis starts with a thorough literature review. Appropriate keywords and search limits are identified and used to find literature that will be incorporated in the meta-analysis. These keywords and search terms are put into appropriate databases (e.g., PubMed and PsychInfo) that are typically available through university libraries. Two articles with exact and concrete steps for conducting solid literature reviews are available in Vincent, Vincent, and Fereira (2006), and Sood, Eerwin and Ebbert (2004).

Meta-analyses will typically include not only formally published studies but also data collected from the "gray literature" (Banks, 2004). This term refers to research used for abstracts, dissertations, preprints, and reports from conference proceedings that are often not readily available in research articles. Finding this information often involves contacting the researchers directly to ask for materials. What typically happens is that amid a literature review, students will find summaries of conferences, dissertation abstracts, or conference proceedings. These summaries will show information relevant to the student's research question but will not include all the relevant data. What these summaries will usually also include is a reference to where the authors were working when the research was conducted. This is the starting place for finding those authors. Libraries often have contact information for university departments across the world, and that can be an excellent place to start for finding ways to contact those authors. However, an online search (using the author's name and research institution) usually works better. Putting in the author's name and institution listed into a search engine will reveal contact information at that institution and will also typically refer to whether the author has moved on to a different setting.

Once relevant studies are collected, the student needs to decide which ones to keep and which to discard. There can be many reasons for discarding articles. They may not fit exactly with the research question. They may not have a research design that the student finds appropriate, or they may not have a sufficient number of subjects. One step that is not considered acceptable for disqualifying an article is when there are not sufficient statistics available. Conducting a meta-analysis requires effort be put forth to obtain missing data (again, by contacting the authors) even when the authors did not publish that information.

Obtaining effect sizes that are not included in research articles can be a daunting task but an important one. This is because the student conducting a meta-analysis does not want to be criticized for not including a research article due to the necessary data not being available. Individuals looking to criticize a meta-analysis could point out that there is no way to know what role a study, deemed to fit adequately into the research question and to have acceptable design and number of subjects, would have had on the meta-analysis results if it had been included. Finding a research study that does not include effect sizes requires that the student contact the authors, using contact information and faculty affiliation included in the articles, and request they provide the necessary information.

Being very clear about why articles are kept and why they are discarded is essential for a meta-analysis because this is where issues related to bias are birthed. An article being discarded means that it will not become part of the final analysis. If there is any possibility that an article

was discarded because the student was concerned it might impact the outcome of the meta-analysis (i.e., might change the results do not support the meta-analysis hypothesis), this can have a grave impact on how well the research community accepts the results. For this reason, the student author needs to be very specific about what articles are included in a meta-analysis. The PRISMA" flowchart is used to detail all the steps that are used in deciding what articles are kept and what is discarded. Moher, Liberati, Tetzlaff, and Altman (2009) provided a copy of this flowchart and outlined the specific ways that it can be used.

All of the work needed for conducting a thorough literature review can be done through a university's library. Even finding contact information for research authors, if additional statistics or information are needed, that material is available through a library. For this reason, conducting the literature review for a meta-analysis is a step that is not negatively impacted by students being in online programs, since online libraries would have access to the same research articles and databases as other universities.

Conducting a meta-analysis requires the use of specialized computer programs. The most common programs available for this purpose are:
- Comprehensive Meta-Analysis (available from www.meta-analysis.com)
- SPSS syntax files (Field & Gillett, 2010)
- Software package for R (also found online under the names "metaphor" and "rubumenta") (Viechtbauer, 2010).

One relatively-new computer program for meta-analysis is called *Meta-Essentials* (Suurmond, van Rhee & Hak, 2017). It runs all the basic statistics needed for a meta-analysis but does not have some of the more advanced meta-analytic methods (included "meta-analytic structural equation modeling" and "meta-regression with multiple covariants") that some students may require. Nevertheless, it is low cost (in fact, free in most cases) and is often easier to run and navigate than some of the other programs.

When setting up the computer program to run a meta-analysis, a decision needs to be made upfront about what "model" of meta-analysis to use. There are two models that are commonly used in meta-analysis: the "fixed effects" model and the "random effects" model (Hedges & Vevea, 1998). Making a decision about which model to use typically is based on what assumptions are made about the research studies. The "fixed effect" model assumes that all studies are from a single common population who are tested under similar circumstances. The "random effects" model assumes that studies are drawn from different populations that have been involved with different testing circumstances. One difference between the two models is that "random effects" tend to give less emphasis to more extensive studies with less variance.

Following obtaining the relevant studies, effect size information is collected from each of the studies. What researchers are looking for are correlations, most commonly the "Pearson's r." Other standard measures of effect size that are reported in studies include "Cohen's d" and "ROC Area" (Rice & Harris, 2005). Once the studies are reviewed, and the correlations are obtained, a decision has to be made about whether to include "partial correlations." Some studies will include this and some will not. "Partial correlations" basically describe the relationships between two variables while taking away the effects of some other variables that might be relevant (Cramer,

2003). It is still reflected in a Pearson's r (or similar correlation statistic) but would be correctly identified as a "partial correlation."

Running a meta-analysis would then involve putting in all the correlations into the computer program and running the appropriate analyses. Within the results of the meta-analysis, the most crucial statistic will be the I^2 statistic. This statistic ranges from 0% to 100% and reflects the proportion of variation that can be attributed to the actual difference between studies. I^2 is the statistic most widely reported by the main meta-analysis computer program and is, thus, widely available in terms of meta-analysis results provided in these programs. It is considered to be largely unaffected by the number of studies in the meta-analysis (Borenstein, Higgins, Hedges, & Rothstein, 2017). What is typically considered to be the threshold for this statistic are 25, 50 and 75% representing low, moderate and high variance.

Rosenthal (1995) provided a useful summary of steps for efficiently writing up a meta-analysis dissertation. First, the authors need to specify the steps used for the literature search and what inclusion criteria were used. Additional information needed include what effect size measures were used and whether fixed- or random-effects models were used. Stem-and-leaf plots of the effect sizes are recommended to summarize what effect sizes were found. Next, statistics of variability and estimates of population effect sizes along with appropriate confidence intervals are reported. Any concerns about what sort of bias might have impacted the studies that were included should also be addressed.

Discussion

The presence of online learning as a legitimate form of education and professional practice has already been established in the U.S. and the world. Inherent in an online learning environment are challenges unique to the population and setting. This includes the demographic make-up of the student population (Baltes & Brown, 2018; Maszynski, 1988), such as older, working adults, as well as the accessibility of resources such as labs, equipment, and populations from which to conduct research (Maszynski, 1988). Up to 40% of doctoral students and up to 60% of online doctoral students do not entirely achieve their doctoral degrees (Baltes & Brown, 2018) in part due to barriers to completing the dissertation.

Online learning need not restrict the student from contributing meaningfully in a scholarly and scientific way to the body of research for which the student is preparing to profess. Schools requiring scientific study in the form of data collection and analysis must look at alternatives. For those students who study in programs requiring scientific evaluation as a function of the dissertation process, the use of meta-analysis is a viable option (Abdullah, 2018). Some examples of programs that have allowed use of meta-analysis for dissertations include Vanderbilt University (e.g. Yang, 2006), Harvard University (e.g. Ablorah, 2015), University of Alabama (e.g. Patrick, 2013) and Loyola University (e.g. Eells, 2011).

With origins in the behavioral sciences, the use of meta-analysis has been expanded in the past 20 years to include hard sciences, and the medical community (Davis, Mengersen, Bennett, & Mazerolle, 2014). Meta-analysis's use is growing invalidity and acceptance among many disciplines. The discussion below presents the risks and benefits of using Meta-analysis in the

dissertation process, along with recommendations for implementing a scientifically sound set of procedures with fidelity.

Risks associated with Meta-analysis

The meta-analysis is a quantitative measurement of similarity/differences among unrelated studies, finding common ground among them or highlighting divergence. It can be utilized to study different populations, and it can also be used to evaluate subgroups between unrelated studies (Borenstein & Higgins, 2013). The premise of the meta-analysis is to purify the breadth of research in the industry, and to discover common themes, removing extraneous variables, unifying the language used to describe the remaining variables, and measuring effect size and power within the pool of data being evaluated. This process can be messy, and it requires diligence on the part of the investigator and reviewers.

For instance, a presumption when collecting data in a meta-analysis is that the various studies being analyzed are independent of one another, and the data they are measuring are discretely separate from the other studies being analyzed (Davis et al., 2014). If the topic being researched is a narrow niche or over-studied, there is a possibility that duplication of the sample population could occur among the studies, negatively exaggerating the effect size of the analysis. Likewise, if many studies being analyzed rely on a small amount of research or a relatively understudied theoretical construct, the analysis can inflate the effect sizes as well (Davis et al., 2014). However, measures to maintain the fidelity of the data collection process can be implemented to reduce these risks.

Another issue that may arise with meta-analysis is the inability of the data to explain effect sizes or lack of effect. It is helpful in these instances to consider additional qualitative analysis to round out the study and provide further clarification of the data, regardless of the results. This can protect against publication bias and can provide an accurate analysis of the data being explored (Davis et al., 2014; Thorne, 2017). Finally, the use of gray data is compatible with meta-analysis, allowing for niche research areas to be exposed, as well as common themes that would otherwise go unnoticed due to small individual studies not demonstrating sufficient power on their own.

Meta-Analyses Examples

Listed below are several examples of meta-analysis that could be useful for students who are considering this research procedure to review to see how the process is done effectively:

1) Cusack, K., Jonas, D. E., Forneris, C. A., Wines, C., Sonis, J., Middleton, J. C. & Weil, A. (2016). Psychological treatments for adults with posttraumatic stress disorder: A systematic review and meta-analysis. *Clinical psychology review*, *43*, 128-141.
2) Houben, M., Van Den Noortgate, W., & Kuppens, P. (2015). The relation between short-term emotion dynamics and psychological well-being: A meta-analysis. *Psychological Bulletin*, *141*(4), 901.
3) Weisz, J. R., Kuppens, S., Ng, M. Y., Eckshtain, D., Ugueto, A. M., Vaughn-Coaxum, R. & Weersing, V. R. (2017). What five decades of

research tells us about the effects of youth psychological therapy: a multilevel meta-analysis and implications for science and practice. *American Psychologist*, *72*(2), 79.

4) Mustian, K. M., Alfano, C. M., Heckler, C., Kleckner, A. S., Kleckner, I. R., Leach, C. R. & Scarpato, J. (2017). Comparison of pharmaceutical, psychological, and exercise treatments for cancer-related fatigue: a meta-analysis. *JAMA oncology*, *3*(7), 961-968.

Recommendations

Conducting a meta-analysis as a means of contributing to the scientific literature can be a rewarding and successful academic achievement, including publication and completion of doctoral requirements for conferral of a Ph.D. The following are ways to enhance the process and contribute to the success of the researcher:

- Participation with a peer-review group or systematic review group, or adherence to the guidelines of such a group (Davis et al., 2014).
- Separation of randomization and non-randomized trials
- Identify and include qualitative research to explain some aspects of the research that cannot be exclusively measured by the use of meta-analysis alone (Davis et al., 2014).
- Consider the use of Meta-synthetic research as an option when meta-analysis is unable to quantify the data being evaluated. A meta-synthesis involves the same concepts as a meta-analysis, except that it is conducted for qualitative, rather than quantitative, research studies (Thorne, 2017).
- Consider the use of gray data when appropriate to reduce publication bias.
- Consider contacting primary researchers to clarify their studies before making assumptions.
- Require students to pre-register their dissertation in order to avoid publication bias after data has been collected (Quintana, 2015). This is a process by which the author(s) of a meta-analysis report details of the meta-analysis before it is conducted. Taking this step helps authors avoid accusations of developing hypotheses after results are known. There is an international database of meta-analyses called the "Prospero database" and use of the "Prisma-P guidelines" for meta-analysis (Shamseer et al., 2015) show researchers how to pre-register the study rationale, study eligibility criteria, search study moderator variables and statistical approaches to be used in a meta-analysis. Many doctoral institutions have their pre-registration groups, most often associated with the IRB/University review programs,that can be used for this same purpose (Davis et al., 2014).

The beauty of the meta-analysis process is that it can be completed entirely online, providing a valuable contribution to the body of research in the field, and furthering the mission of online learning in developing professionals and industry experts. Conducting a meta-analysis for dissertations helps to overcome issues associated with non -traditional learners, including time constraints, location of the student and distance from school, lack of access to subjects, equipment, and labs. Meta-analyses can be structured in ways that take into account differences associated

with online dissertations while also providing fidelity of the study using the existing resources of the institution. Using meta-analyses for dissertations allows for meeting the particular needs of online doctoral students while also providing results that advance theoretical and empirical understanding of important research topics (Biccard, 2015; Koraceiv, 2013; Rasouli, Manoochehry, Ahmadpour & Farajzdeh, 2017). These are essential reasons why quantitative dissertation committees at online doctoral institutions should give serious consideration of this model of investigation as a viable dissertation option.

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