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A Multimodal Degree Completion Needs Analysis of Agricultural and Extension Education Graduate Students in Sub-Saharan Africa

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Abstract

Increasing doctoral degree holders in Sub-Saharan Africa may significantly impact the quality and quantity of undergraduate and graduate programs. Research capacity is crucial to successfully completing a thesis or dissertation and obtaining a graduate degree. Unfortunately, in Sub-Saharan Africa, many students abandon or delay their degrees at this stage due to limited research and writing skills. This study aimed to identify the most critical thesis and dissertation (TD) research needs of masters and PhD students from Sub-Saharan Africa. Thirty-eight skills were identified from the literature and presented to agricultural education and extension/leadership students. Borich (1980) and Witkin (1984) needs assessment models were used to ascertain the perceived importance and extent of students' knowledge of TD topic areas. The top identified needs were extracting a manuscript from a thesis, writing a journal article, choosing inferential statistics, deciding the descriptive statics, and what to review in the literature. A total of 15 items were identified as critical needs using the Witkin model. The findings identified challenges and opportunities for improving Sub-Saharan African graduate students' research knowledge and TD performance, implying that combining the two models to identify training needs may produce more comprehensive results than using only one methodology.

Keywords

Witkin, Borich, research needs, graduate degree completion, Sub-Saharan Africa

Authors

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Abstract

Increasing doctoral degree holders in Sub-Saharan Africa may significantly impact the quality and quantity of undergraduate and graduate programs. Research capacity is crucial to successfully completing a thesis or dissertation and obtaining a graduate degree. Unfortunately, in Sub-Saharan Africa, many students abandon or delay their degrees at this stage due to limited research and writing skills. This study aimed to identify the most critical thesis and dissertation (TD) research needs of masters and PhD students from Sub-Saharan Africa. Thirty-eight skills were identified from the literature and presented to agricultural education and extension/leadership students. Borich (1980) and Witkin (1984) needs assessment models were used to ascertain the perceived importance and extent of students' knowledge of TD topic areas. The top identified needs were extracting a manuscript from a thesis, writing a journal article, choosing inferential statistics, deciding the descriptive statics, and what to review in the literature. A total of 15 items were identified as critical needs using the Witkin model. The findings identified challenges and opportunities for improving Sub-Saharan African graduate students' research knowledge and TD performance, implying that combining the two models to identify training needs may produce more comprehensive results than using only one methodology.

Keywords: Witkin, Borich, research needs, graduate degree completion, Sub-Saharan Africa

Introduction and Literature Review

Increasing the number of masters and PhD graduates in Africa impacts the quality of higher education as employability has been directly linked with degree completion and skills obtained (Hayward & Ncayiyana, 2014; Gungea, 2019). African universities must recruit, train, and supply graduate students with the necessary research skills to engage in meaningful innovations so that they will be globally competitive in this new era (Owusu et al., 2017). Research abilities are crucial in higher education, particularly at the graduate level (Affero & Abiddin, 2009; Airhihenbuwa et al., 2011; Elgar & Klein, 2004). While graduation, persistence, and attrition are the primary indicators of successful and high-quality graduate studies (Breitenbach, 2019), the majority of graduate students in Sub-Saharan Africa postpone or abandon their theses or dissertations (TD) due to a lack of research and writing skills, and thus never complete their degrees (Elgar & Klein, 2004; Hayward & Ncayiyana, 2014; Motseke, 2016). Graduation, leading to employment that allows for future knowledge creation, is directly contingent upon these students' ability to conduct original empirical research required to complete their TD and obtain their graduate degree (Gibbs et al., 2012).

Graduates (particularly those with PhDs) must also possess sufficient research abilities to teach, mentor, supervise students effectively, and engage in future research endeavors (Horowitz & Christopher, 2013). Apart from serving as faculty in academic institutions, graduates with adequate research abilities also join the private sector (Elgar & Klein, 2004). There is a demand for graduate-level employees; however, many graduates fail to secure positions because they lack the necessary skills required in the research positions (Elgar & Klein, 2004; Gungea, 2019). Research skills are applicable across a myriad of sectors as society wrestles with complex social problems in the areas of health, nutrition, governance, equal opportunity, and environmental protection (MacGregor; 2020; Schofer & Meyer, 2005).

Previous research within the literature suggests that completing the TD phase is a difficult task for students globally, causing many to delay or quit graduate studies altogether (Almoustapha & Uddin, 2017; Breitenbach, 2019; Gibbs et al., 2012; Lessing & Lessing, 2004; Parrish, 1989). Some of the challenges identified in the literature impacting the TD phase include limited research skills, supervisory arrangements, institutional factors, student characteristics, computer skills, and internet access (Almoustapha & Uddin, 2017; Heide et al., 2019; Luan & Fenske, 1996; Mohamed et al., 2012). During the TD phase, graduate students assume the role of knowledge creators; however, many find the transition difficult (Breitenbach, 2019). The TD phase requires graduate students to conduct research, analyze data, and effectively communicate research findings, which all require adequate research and technical writing skills (Horowitz & Christopher, 2013).

Previous studies have examined graduate student needs (e.g., Bussell et al., 2017; Fidzani, 1998; Fong et al., 2016; Gibbs et al., 2012; Hegarty, 2011; Hoffmann et al., 2008; Horowitz & Christopher, 2013; Kinsley et al., 2015; O'Clair, 2013; Parrish, 1989). Motivation, workshops, working space, information seeking, research mentorship, and library research have all been examined and identified as necessary (Bussell et al., 2017; Fidzani, 1998; Fong et al., 2016; Hegarty, 2011; Horowitz & Christopher, 2013; Kinsley et al., 2015). Bussell et al.'s (2017) mixed-methods study of 4,486 graduate students at a large public research university determined the need to improve graduate students' research abilities from basic keyword selection to advanced data mining. Bussell et al. (2017) established that graduate students lacked confidence in writing citations and had challenges locating, analyzing, referencing, storing, and managing

data. Gibbs et al. (2012) identified three research needs of Georgetown University graduate students' research habits and library use, which included infrastructure (library structure, furnishings, and allocated space for graduate students), knowledge and scholarly support (awareness of specialist library resources and services and customized orientation and education), and access services (availability of resources on and off-campus, interlibrary and consortia lending, and borrowing policies).

Hoffmann et al. (2008) conducted a needs assessment of graduate students' perceptions about library research needs and the feasibility of a shared training program. Hoffmann et al. established that students needed knowledge on information-finding strategies, bibliographic management systems like RefWorks, and tools for staying current with academic literature. O'Clair (2013) examined how a graduate-level information research course affected students' self-reported confidence and preparation. O'Clair found a positive relationship between students' perceived confidence and readiness for graduate-level research and perceptions of obtained content as informative and instrumental for successful completion of their theses. Despite the extensive literature on graduate student competencies more generally, only a few studies have examined graduate students' research-related needs such as research habits, research mentoring, graduate-level courses, and the research environment (Bussell et al., 2017; Gibbs et al., 2012; Hoffmann et al., 2008; Horowitz & Christopher, 2013; O'Clair, 2013; Parrish, 1989).

Sub-Saharan Africa Graduate Programs

Specific challenges facing graduate students have been identified in Sub-Saharan Africa, including academic performance, knowledge exchange, information needs and seeking behavior, ICT use, lack of funding opportunities, and experiences of graduate students within their programs (Duchelle et al., 2009; Fidzani, 1998; Fongwa, 2018; Hagedorn & Ren, 2012; Hayward, 2012; Hayward & Ncayiyana, 2014; Herselman, 2003; Hoffmann et al., 2008b; Hofman et al., 2013; Kumi-Yeboah, 2014; Marcketti et al., 2006; Offstein et al., 2004; Whitworth et al., 2008). Hayward and Ncayiyana (2014) examined graduate education in Sub-Saharan Africa relative to limited donor financing. Hayward and Ncayiyana (2014) identified limited robust research evidence, a scarcity of faculty members knowledgeable about current research methodologies, and a deficiency in students' capacity to formulate appropriate research questions and proposals.

Whitworth et al. (2008) identified a gap in development and health research and offered suggestions to strengthen health research in institutions of higher learning in Africa. Whitworth et al. (2008) proposed developing competitive grants and fellowship programs, providing institutional support for infrastructure, management, and technical services, promoting networks and partnerships, and utilizing funding mechanisms as change agents in African institutions. Hofman et al. (2013) investigated training shortages, barriers, and opportunities for health equity and social determinants of health (SDH) training programs in Ghana, Tanzania, and South Africa. According to Hofman et al. (2013), SDH-related training was accessible; however, limited student placement and insufficient money put pressure on both students and training institutions, resulting in reduced participation and quality research.

The literature suggests that educators recognize the value of conducting in-depth needs analyses for high-quality instructional or training programs (Barrick et al., 1983). An effective training program must assess and integrate the learning needs of students (Ulschak, 1983). Correspondingly, there is a robust literature base regarding graduate students' learning needs based on techniques such as the Borich (1980) and Witkin (1984) models in the United States

(Cox et al., 2004; Garton & Chung, 1997; McKim, 2013; McKim & Saucier, 2011). However, a limited number of studies have looked into the research needs of graduate students in Sub-Saharan Africa as it relates to TD completion.

Conceptual Framework

The Borich (1980) needs analysis model and Witkin (1984) needs assessment model were used to create the conceptual framework for the study. Knowles (1980) defined a need as a gap or discrepancy between existing knowledge or skills and desired knowledge or skills. Borich (1980) described a training need as a discrepancy between educational goals and trainee performance in relation to the goal. Witkin (1984) defined needs assessment as a systematic approach to analyzing people's needs and determining the best ways to meet them. Previous research established that needs assessments may assist in identifying learning problems and skill needs in educational settings, and consequently, the course selection and curriculum design or re-adjustment needs (Cox et al., 2004). Pratt (1994) posited that an analysis of teaching and learning needs should enable courses to be built around learning requirements and not just teaching requirements. Therefore, an effective training program must first evaluate and integrate the training needs of students to make teaching learner-centered (Ulschak, 1983). Needs assessment tools are well established for public education to identify and clarify institutional goals or training needs (English, 1977).

The Borich model (1980)

Borich's (1980) needs assessment model uses a mean weighted discrepancy score for each item, competency, or activity assessed (McKim & Saucer, 2011). A discrepancy analysis "… identifies the two polar positions of what is and what should be" by comparing program participants' behaviors, skills, and competencies with the program goals (Borich, 1980, p. 39). For example, the model may be used to compute a discrepancy score (DS) by subtracting a respondent's competence/knowledge rating from their perceived importance rating for an item. A weighted discrepancy score (WDS) is then calculated for each participant by multiplying the mean importance rating by the discrepancy score for each item. Lastly, a mean weighted discrepancy score (MWDS) is calculated for each item by dividing the sum of WDS by the total number of observations.

Borich's (1980) needs analysis model has been used to identify the agricultural education training needs of high school students, teachers, and pre-service or in-service teachers (Garton & Chung, 1997; Layfield & Dobbins, 2002; McKim, 2013; Saucier et al., 2014; Saucier & McKim, 2011; Sorensen et al., 2014; Yopp et al., 2017). The scope of many such studies focused on agricultural education teaching competence and professional development needs of experienced teachers (McKim, 2013; Sorensen et al., 2014); mechanic laboratory learning needs of student teachers (Saucier & McKim, 2011); teaching competence of in-service teachers (Garton & Chung, 1997); information technology use in teaching, FFA and award preparations (Layfield & Dobbins, 2002); and social and emotional learning skills (Yopp et al., 2017). In previous research focused on agricultural education, the two common types of Borich-related discrepancy scores are *importance* and *ability* or what is and what should be (McKim & Saucer, 2011).

The Witkin Model (1984)

The Witkin Model (1984) calls for the calculation of the grand mean scores for importance (X) and a mean score for inclusion (Y). The model plots the mean scores of importance and knowledge on the X and Y axes, respectively. The axes allow for the visualization of four quadrants within the domain of interest. Mean importance and mean inclusion scores of items of interest are then plotted. The individual item mean scores are then associated with the four quadrants established through grand mean scores (Witkin, 1984). The four quadrants are named: critical need (CN) representing high importance and low knowledge, high-level successful ability (HLSA) representing high importance and high knowledge, low-level successful ability (LLSA) representing low importance and high knowledge, or low-level need (LLN) representing low importance and low knowledge. According to Witkin (1984), priority should be on items in the CN area in regard to program innovation or interventions; educators should maintain excellence for items in the HLSA quadrant; items in the LLSA quadrant should be analyzed for less emphasis or possible removal from the curriculum; lastly, items in the LLN quadrant are the lowest priority.

The Witkin (1984) needs assessment tool has been utilized to identify and categorize skill levels and skill areas that require elimination or emphasis in the curriculum and immediate capacity building for enhanced training. For instance, Garton and Chung (1997) used Witkin's model to determine the in-service needs of beginning agricultural teachers. Garton and Chung (1997) identified sixteen competencies for in-service education that required attention, including utilizing multimedia for teaching about agriculture and the environment and conducting parent-teacher conferences. Cox et al. (2004) also used Witkin's (1984) model to determine agricultural science teachers' perceived water-related curriculum needs regarding the Ogallala Aquifer. Cox et al. (2004) identified and classified fifty-five high school curriculum needs focused on water education.

Purpose and Research Objectives

The purpose of this study was to determine the TD research needs of agricultural education graduate students in Sub-Saharan Africa. The specific objectives of the study were:

1. Identify TD research needs of agricultural education graduate students in Sub-Saharan Africa using mean weighted discrepancy scores (MWDS).
2. Describe the TD research abilities of agricultural education graduate students in Sub-Saharan Africa using the quadrant analysis model.

Methods

Population and Respondents

The target population for the study was agricultural education and extension graduate students (masters and PhD) in Sub-Saharan Africa. The study sample was purposive, including agricultural education graduate students at Egerton, Kyambogo, Sokoine, and Haramaya universities which are all located in Sub-Saharan Africa. A census approach was used with 65 individuals receiving an invitation to participate in the study and 65 responses obtained for a 100% response rate. While the response rate was deemed acceptable based on established social

science response rates within the literature (Baruch & Holtom, 2008) and indicative of the population of interest, the findings are associated with the specific universities where data were collected and are not truly representative of all universities within Sub-Saharan Africa. This study was a part of a larger research project resulting in publications from a common dataset (Kirkman & Chen, 2011).

Instrumentation and Data Collection

The instrument development process and subsequent data collection were completed in three phases. First, the instrument was developed. Second, a pilot test of the instrument was conducted to establish instrument content, response process, and internal structure validity (Lamm et al., 2020). Lastly, data were collected from a sample representing the population of interest. Respondents in the pilot and research phases of the study completed the survey online using the Qualtrics™ tool.

In the first phase of the process, instrument development, a thorough review of the literature was undertaken. The review focused on graduate student research and general success characteristics. A total of 38 items were identified for inclusion in the instrument. The 38 items were grouped into seven multi-item research topics specifically associated with the TD development process for data interpretation purposes. The seven higher-level topic areas included:1) introduction (two items) 2) literature review (four items); 3) population and sampling (four items); 4) instrument design and administration (19 items); 5) data analysis (four items); 6) results, discussion and conclusion (two items); and 7) disseminating findings (three items). Each of the 38 items was measured on a five-point Likert-type scale ranging from one (low) to five (high) for both knowledge level (little knowledge – very much knowledge), and importance level (not important – very much important).

The proposed instrument was reviewed by a panel of experts. The panel members had expertise in instrument development methodology, graduate student education, and experience with working in Sub-Saharan African context. A pilot test of the instrument was then conducted with a convenience sample representative of the respondents in the United States and Kenya (n = 30). Respondents were asked to complete the questionnaire and provide any information that could help improve or clarify the instrument. Limited feedback was obtained through cognitive interviews. Reliability analysis of the pilot data yielded Cronbach's alpha coefficients above .97 for the proposed constructs, indicating acceptable internal structure validity. The thirty-eight knowledge and importance statements were thus retained as initially stated for use in the full data collection phase. Potential study respondents received a cover letter linked to the online questionnaire through their respective program leaders in the Agricultural Education and Extension departments. Two reminder messages were sent approximately once per week and all potential responses were obtained (N = 65).

Borich (1980) Data Analysis Procedure

To address research objective one, the Borich (1980) model analysis was completed on 38 TD items that represented seven primary categories. Specifically, the analysis utilized the Microsoft Excel-based Mean Weighted Discrepancy Score Calculator developed by McKim and Saucer (2011). The individual scores from respondents for each item are entered into the calculator in the knowledge and importance columns. The calculator then computes the discrepancy scores (DS), weighted discrepancy scores (WDS), and mean weighted discrepancy

scores (MWDS) for each item. The DS was calculated for each of the thirty-eight TD items by subtracting participants' mean knowledge level from the mean importance level. The WDS was computed by multiplying the mean importance rating by the discrepancy score for each item. An MWDS was finally calculated for each item by dividing the sum of the weighted discrepancy scores by the total number of observations (n = 65). The MWDS were then ranked from highest to lowest, as tabularized in the results section. Based on the MWDS analysis, items with positive scores indicated higher levels of perceived importance of a topic relative to perceived knowledge of the topic.

Witkin's (1984) Data Analysis Procedure

To address research objective two, describing the TD research abilities of graduate students, the researcher utilized Witkin's (1984) model. The model established four quadrants to classify TD research skills as critical need (CN), high-level successful ability (HLSA), low-level successful ability (LLSA), or low-level need (LLN). First, average knowledge and importance scores for each of the 38 TD items were computed for each student. Next, knowledge and importance grand mean scores for each TD multi-item research topic were computed. For example, within the literature review topic area, the grand mean of the four constituent items was calculated. Next, grand mean scores were transferred onto a Microsoft Excel worksheet and then plotted on an X/Y line graph using the Insert command for Microsoft Word charts. The Y-axis represented knowledge scores, and the X-axis represented importance scores. The grand mean score of knowledge and importance plotted on the X/Y line chart resulted in four quadrants (CN, HLSA, LLSA, and LLN). Each item within the multi-item research topic areas was identified as a CN, HLSA, LLSA, or LLN based on an individual item means scores for both knowledge and importance.

Results

Objective One

All 38 items were ranked from the highest (1) to lowest (38) need area using their MWDS. Based on the Borich (1980) analysis, the twelve highest rated items had MWDS values of five and above (Table 1). The twelve items included: extracting a manuscript from the thesis, writing a journal article, choice of inferential statistics, deciding the descriptive statistics, deciding what to review, response rates, data analysis with statistical software, writing knowledge items, face validity, previously developed instruments, and lastly external validity/generalization of results. A total of six items with negative scores were observed, indicating higher levels of perceived knowledge than importance. Specifically, items with negative scores included: research ethics, hypothesis testing, developing a theoretical framework, selecting a representative sample, presenting the results in APA or any other designated style format, and research problem formulation.

Table 1

TD Needs of Graduate Students from Sub-Saharan Africa Using Borichs' MWDS (N = 65)

Sub-Topics of TD	Main Topics of TD	MWDS	Rank
Extracting a manuscript from the thesis	Disseminating Findings	7.35	1
Writing a journal article	Disseminating Findings	7.09	2
Choice of inferential statistics	Data Analysis	6.88	3
Deciding the descriptive statistics	Data Analysis	6.65	4
Deciding what to review	Literature Review	6.52	5
Response rates	Instrument Design	5.85	6
Data analysis with statistical software	Data Analysis	5.71	7
Writing knowledge items	Instrument Design	5.30	8
Face validity	Instrument Design	5.29	9
Previously developed instruments	Instrument Design	5.27	10
External validity/result generalization	Instrument Design	5.02	11
Structuring and formatting	Instrument Design	5.00	12
Recommended journals	Disseminating Findings	4.95	13
Deciding how to ask	Instrument Design	4.91	14
Conceptual framework	Literature Review	4.87	15
Non-response error	Instrument Design	4.85	16
Managing citations	Literature Review	4.81	17
Content validity	Instrument Design	4.80	18
Organizing results in tables and figures	Results, Discussion, and Conclusion	4.59	19
Pilot testing instrument for Reliability/internal consistency	Instrument Design	4.56	20
Sampling method selection	Population and Sampling	4.42	21
Likert-type items related to survey	Instrument Design	4.26	22
Selecting the accessible population	Population and Sampling	4.08	23
Writing affective items	Instrument Design	4.06	24
Writing behavioral/application items	Instrument Design	3.84	25
Administering a survey method	Instrument Design	3.61	26
Linking instrument items to research objectives	Instrument Design	3.50	27
Reliability	Instrument Design	3.50	28
Deciding items to ask	Instrument Design	3.36	29
Determining the target population	Population and Sampling	3.33	30
Research objective formulation	Introduction	3.32	31
Self-developed instruments	Instrument Design	2.60	32
Research problem formulation	Introduction	-2.07	33
Presenting the results in APA or any other designated style format	Results, Discussion, and Conclusion	-3.06	34
Selecting a representative sample	Population and Sampling	-3.07	35
Developing a theoretical framework	Literature Review	-3.69	36
Hypothesis testing	Data Analysis	-3.80	37
Research ethics	Instrument Design	-4.90	38

Note. MWDS = Mean Weighted Discrepancy Score.

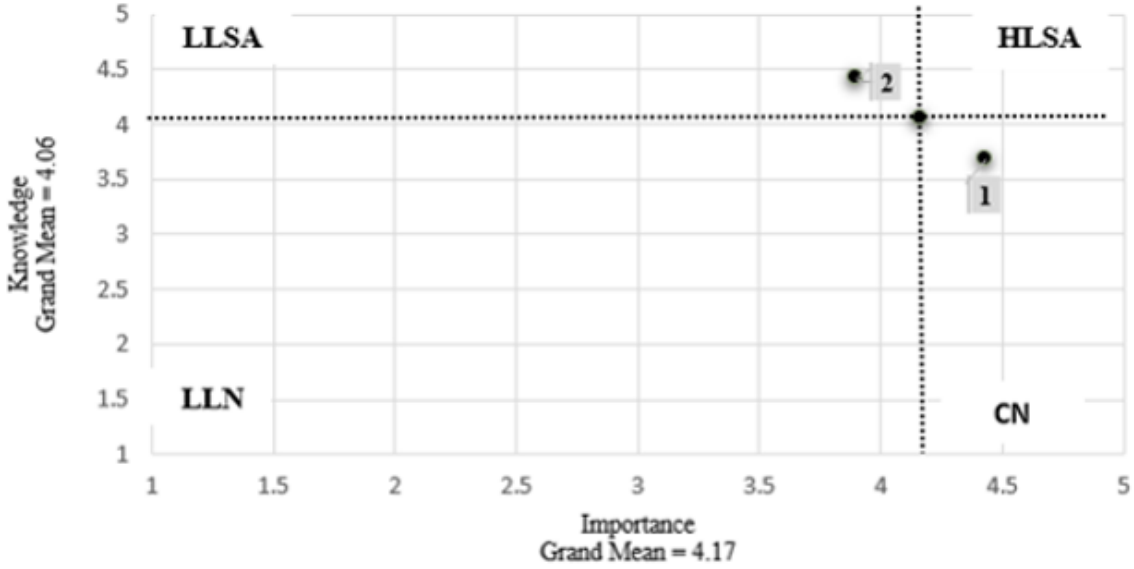
Objective Two

To answer the research objective two, knowledge and importance grand mean scores for the seven multi-item research topics were analyzed using the Witkin's (1984) model that places them into quadrants as depicted by the figures (1 to 7).

The introduction topic area had two items and based on the grand mean score analysis, subsequent quadrant generation. The item *formulating research objectives* fell in the CN quadrant, implying high importance but limited knowledge among respondents. *Formulating a research problem* fell in the LLSA quadrant, indicating higher perceived knowledge levels than importance (Figure 1).

Figure 1

Needs Assessment Quadrants – Introduction Topic Area

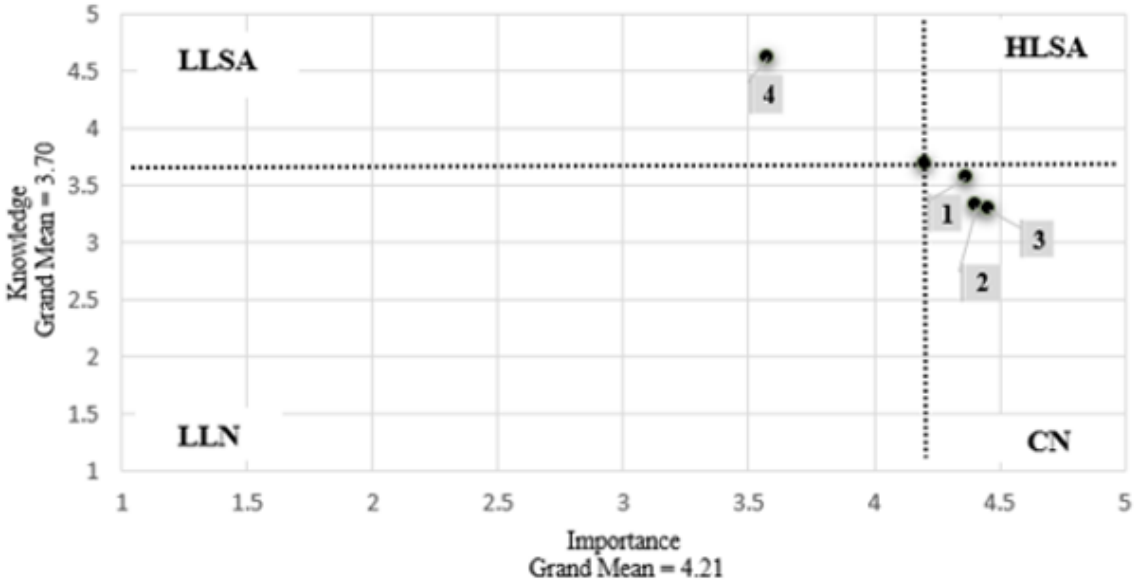


Note. Quadrant is LLSA = Low level successful ability, LLN = Low level need, HLSA = High level successful ability, CN = Critical need. TD Sub-Topic is 1 = Research objective formulation, 2 = Research problem formulation.

The literature review topic area included four items. Three of the four items were identified in the CN quadrant, indicating perceptions of high importance but of limited knowledge among respondents, including *what to review*, *managing citations*, and *conceptual framework* (Figure 2).

Figure 2

Needs Assessment Matrix – Literature Review

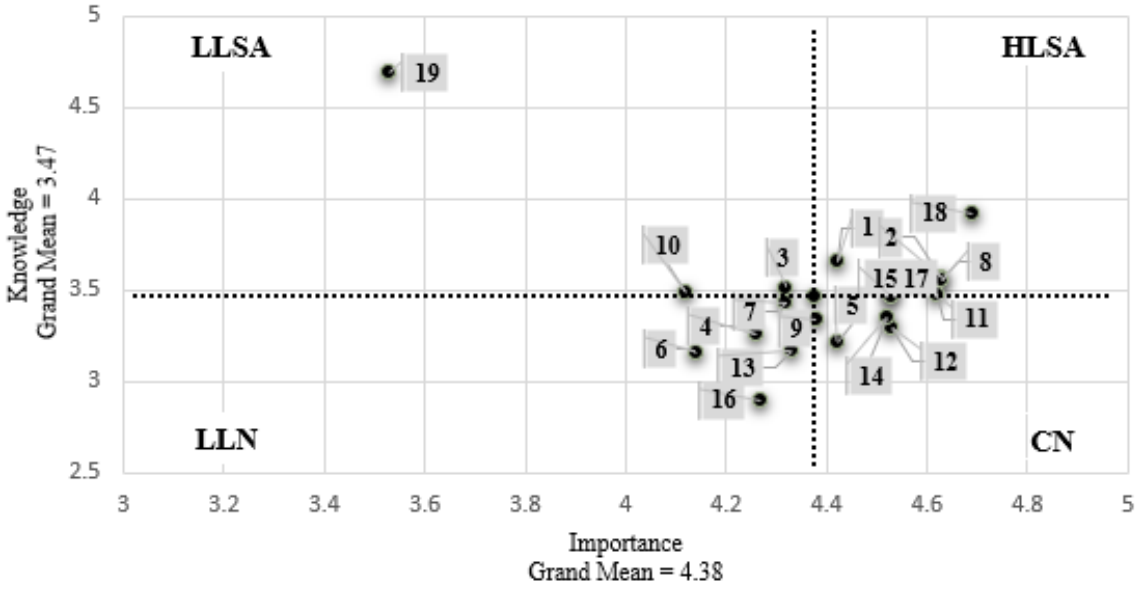


Note. Quadrant is LLSA = Low level successful ability, LLN = Low level need, HLSA = High level successful ability, CN = Critical need. TD Sub-Topic is 1 = Deciding what to review, 2= Managing citations, 3 = Conceptual framework, 4 = Theoretical framework.

Nineteen items were included within the instrument design and administration topic area (Figure 3). There were items located within all four quadrants. Specifically, there were five items identified in the CN quadrant, indicating perceptions of high importance but of limited knowledge among respondents, including *writing knowledge items*, *reliability*, *face validity*, *non-response error*, pilot testing, and *previously developed instruments*. Furthermore, in the HLSA quadrant, high importance and high knowledge items included *deciding items to ask, how to ask, structuring and formatting instruments, previously developed instruments, content validity,* and *administering a survey method*. The remainder of the topic items fell into the LLSA and LLN quadrants (Figure 3).

Figure 3

Needs Assessment Matrix – Instrument Design and Administration Topic Area

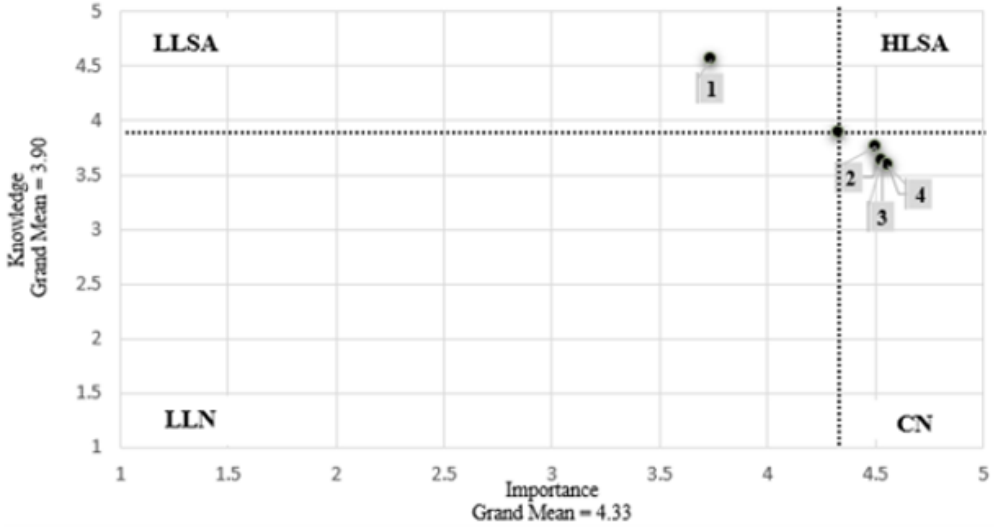


Note. Quadrant is LLSA = Low level successful ability, LLN = Low level need, HLSA = High level successful ability, CN = Critical need. TD Sub-Topic is 1= Deciding items to ask, 2 = Deciding how to ask, 3 = Linking instrument items to research objectives, 4 = Likert-type items related to survey research, 5 = Writing knowledge items, 6 = Writing affective items, 7 = Writing behavioral/application items, 8 = Structuring & formatting, 9 = Pilot testing the instrument for reliability/internal consistency, 10 = Self-developed instruments, 11 = Previously developed instruments, 12 = Reliability, 13 = External validity/generalization of results, 14 = Face validity, 15 = Content validity, 16 = Response rates, 17 = Non-response error, 18 = Administering a survey method, 19 = Research ethics.

Four items were included within the population and sampling topic area (Figure 4). Three items were identified in the CN quadrant, indicating perceptions of limited knowledge and high importance, including *selecting an accessible population, selecting a sampling method, and selecting a representative sample*. One item, *determining target population*, was identified in the LLSA quadrant indicating perceptions of low importance and high knowledge amongst respondents.

Figure 4

Needs Assessment Matrix – Population and Sampling Topic Area

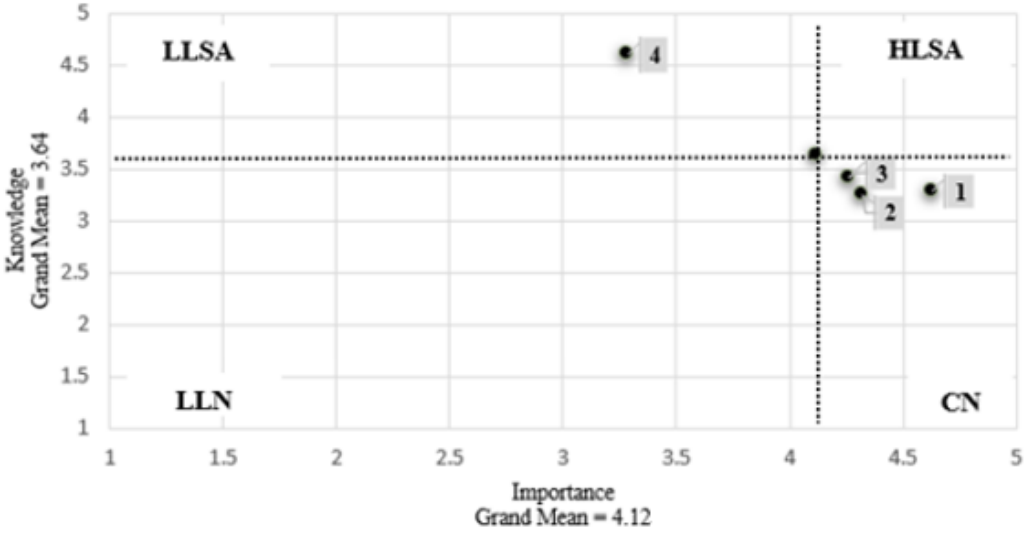


Note. Quadrant is LLSA = Low level successful ability, LLN = Low level need, HLSA = High level successful ability, CN = Critical need. TD Sub-Topic is 1 = Determining target population, 2 = Selecting accessible population, 3 = Sampling method selection, 4 = Selecting a representative sample.

The data analysis topic area was comprised of four items (Figure 5). The *choice of inferential statistics to use*, *deciding which descriptive statistics to use* and *data analysis with statistical software* were identified within the CN quadrant indicating perceptions of high importance but limited knowledge among respondents.

Figure 5

Needs Assessment Matrix – Data Analysis Topic Area

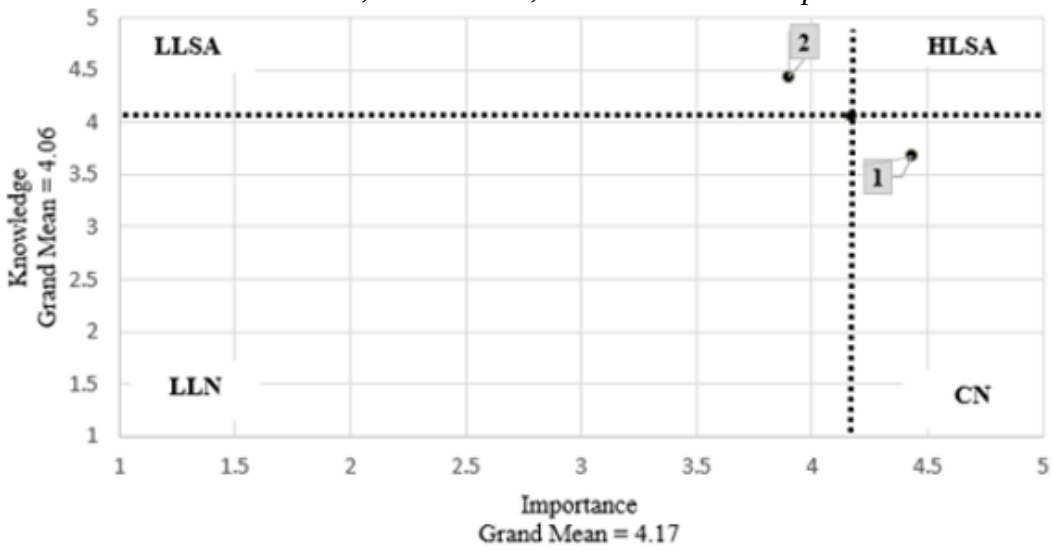


Note. Quadrant is LLSA = Low level successful ability, LLN = Low level need, HLSA = High level successful ability, CN = Critical need. TD Sub-Topic is 1 = Deciding the descriptive statistics to use, 2 = Choice of the inferential statistics to use, 3 = Data analysis with statistical software, 4 = Hypothesis testing.

The results, discussions, and conclusion topic area included two items (Figure 6). *The organizing results in tables/figures* item was located in the CN quadrant implying perceptions of high importance but limited knowledge among respondents. *Presenting results in APA or other formats* rated as a LLSA need indicating perceptions of low importance and high knowledge amongst respondents.

Figure 6

Needs Assessment Matrix – Results, Discussions, and Conclusions Topic Area

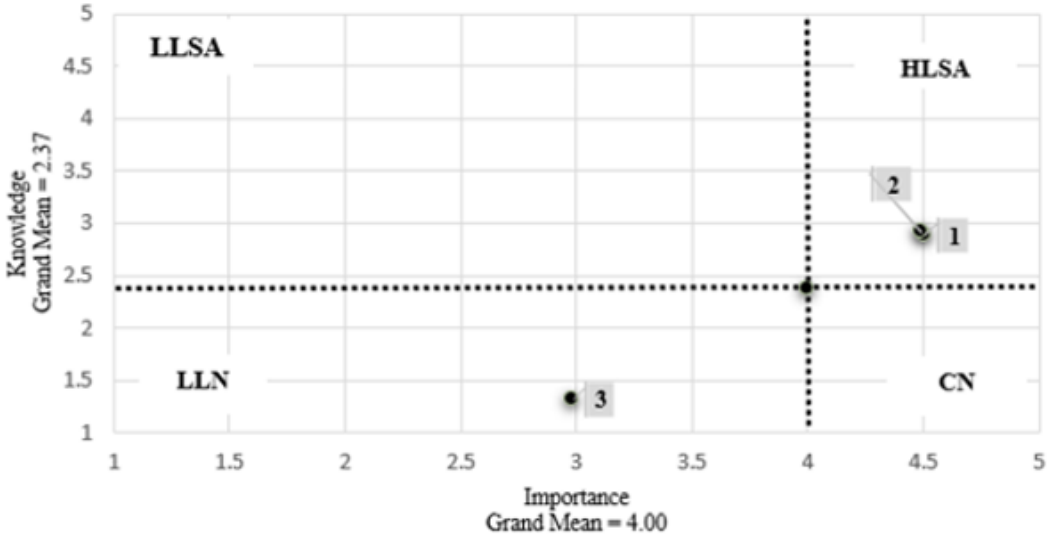


Note. Quadrant is LLSA = Low level successful ability, LLN = Low level need, HLSA = High level successful ability, CN = Critical need. TD Sub-Topic is 1 = Organizing Results in Tables/Figures, 2 = Presenting Results in APA/Other Formats.

The dissemination of findings topic area included three items (Figure 7). *Extracting a manuscript* and *writing a journal article* items fell in the HLSA quadrant implying skill sets of high knowledge and high importance among graduate students. The *recommended journals* topic area fell in the LLN quadrant, indicating an item of low importance and limited knowledge amongst respondents.

Figure 7

Needs Assessment Matrix – Disseminating Findings Topic Area



Note. Quadrant is LLSA = Low level successful ability, LLN = Low level need, HLSA = High level successful ability, CN = Critical need. TD Sub-Topic is 1 = Extracting a manuscript, 2 = Writing a journal article, 3 = Recommended Journals.

Conclusions and Discussion

Using the Borich (1980) model, the results indicated a range of perceived needs among respondents. The largest MWDS was observed with *extracting a manuscript from a thesis* item, and the second-largest MWDS was *writing a journal article*. Both items existed within the disseminating findings research topic area. The third, fourth, and sixth largest observed MWDS were observed with the *choice of inferential statistics* item, *deciding the descriptive statistics item,* and *data analysis with a statistical software* and were all located within the data analysis topic area. The fifth-largest MWDS, *deciding what to review*, was in the literature review topic area. The sixth to fifteenth largest observed MWDS, *response rates, face validity, previously developed instruments, structuring and formatting, writing knowledge items,* and *non-response error* were all located in the instrument design topic area. The Borich calculator did not yield items with MWDS scores higher than five for the topic areas of introduction, population and sampling, and results and conclusion. Therefore, overall, the results from the Borich (1980) analysis indicated a range of perceived needs related to TD among respondents with the most significant emerging.

The Witkin (1984) model used a quadrant mapping method as an alternative analytical technique for the 38 TD items. Specifically, the items were analyzed at the topic area level providing an opportunity to consider each topic item from a relative perspective. Based on topic area grand mean scores, four quadrants were established. The CN and HLSA quadrants represent top priority areas that should be monitored and areas of focus for further capacity building (Witkin, 1984). The LLSA and LLN quadrants represent lower priority areas where specific items may be deemphasized and possibly deferred or omitted from the curriculum altogether (Witkin, 1984). Across all seven topic areas, there were 15 items in the CN quadrant, 11 items

located in the HLSA quadrant, six items located in the LLSA quadrant, and six items located in the LLN quadrant.

The findings of the Borich (1980) and Witkin (1984) models triangulated, corroborated, and validated the needs identification process of graduate students' research needs for TD completion in Sub-Saharan Africa. Those items that ranked as greatest needs or areas of importance by their MWDS (Borich, 1980) fell in the CN, HLSA quadrants (Witkin, 1984). For example, *extracting a manuscript, writing a journal article, selecting an inferential test to run, selecting descriptive statistics to use, deciding the descriptive statistics to use, and deciding what to review* were ranked highest (most important) using the MWDS (Borich, 1980) and were also located in the HLSA and CN quadrants (Witkin, 1984). Additionally, while response rate, recommended journals, and external validity items ranked as areas of high need, they fell into the LLN quadrant, indicating perceived limited knowledge and importance items. Additionally, the observation could indicate areas of deficiency in awareness that should be brought to the attention of graduate students.

The results also provide insights regarding TD research capacity building and need assessment methodologies—for example, the Borich (1980) MWDS data allowed priority ranking across all items. In parallel, the Witkin (1984) model analysis provided an alternative data interpretation. For example, within the instrument design and administration topic area, there were 19 unique items. The MWDS scores rankings of these 19 items ranged from seven to 38. The 19 items were then plotted using the Witkin (1984) model, with items emerging across all four quadrant areas. The results of the Witkin (1984) analysis helped to clarify further training and support needs based on the location of items in the CN quadrant. Specifically, reliability (MWDS rank 7) response rate (MWDS rank 8), face validity (MWDS rank 9), previously developed instruments (MWDS rank 10), content validity (MWDS rank 15), and self-developed instruments (MWDS rank 31) were all located within the CN quadrant.

Furthermore, the use of both the Borich (1980) and Witkin (1984) models demonstrated how data could be analyzed and visualized across differing levels for different outcomes. For example, the overarching disseminating findings topic area had the top two MWDS items: extracting a manuscript from the thesis and writing a journal article. However, it would not be advisable to prioritize these items to the detriment of other actions required for successful TD research, particularly across all seven topic areas. The Witkin (1984) model provided an alternative interpretation of the data; specifically, the two top MWDS items may not necessarily be critical needs based on their location within the HLSA quadrant. A recommendation would be to use the seven topic areas as a heuristic guide to TD research skills and focus developmental efforts on those items appearing in the CN and HLSA quadrants for each of the topic areas. The approach may help ensure all topic areas are covered while providing a schema for prioritizing foci with the topic areas.

Implications and Recommendations

Overall, the findings imply a great need to improve graduate programs teaching research skills in Sub-Saharan Africa if enhanced TD completion rates are desired. Interventions aimed at improving the TD research skills of graduate students from Sub-Saharan Africa should prioritize or emphasize the greatest MWDS-ranked needs and those located in the CN and HLSA quadrants. The needs included: *research objective formulation, deciding what to review, managing citations, conceptual framework, writing knowledge items, reliability, face validity,*

non-response error, previously developed instruments, selecting accessible population, sampling method, selecting a representative sample, deciding on the descriptive statistics to use, choice of the inferential statistics to use, data analysis with statistical software, organizing results in tables/ figures, extracting a manuscript, writing a journal article, deciding items to ask, structuring and formatting instruments, previously developed instruments, and administering a survey method.

These are critical, high-need, and high-priority needs that require capacity building and inclusion in the curriculum (Borich, 1980; Witkin, 1984). Therefore, graduate program administrators and research instructors should tailor curriculum changes based on the CN and HLSA's highest need scores. Graduate program directors could tailor their curricula to include more research courses and professional development sessions that provide students with additional knowledge and experience in TD items of high need and limited knowledge. Additionally, the curriculum should include activities that expose graduate students to free and affordable online resources (e.g., Leard Statistics, Weft QDA, PSPP – a free version of SPSS, www.ref-n-write.com, www.lynda.com, LaTex, ZOTERO, Grammarly.com, and YouTube). Together with external collaboration, these resources should enhance TD research and writing skills and increase students' awareness of other valuable TD skills they may not know. Meanwhile, the institutions evaluated should evaluate their research teachers' training needs and, if possible, enhance their ability to teach effectively and recognize students' TD needs.

Future research should replicate the study with a larger sample of students from more universities in Sub-Saharan Africa to further confirm the results and enhance generalizability to the entire population of interest. Furthermore, instructors at these institutions should respond to the same research questions to see how the results compare to students' results. Study replication should reveal additional TD research issues, including instructional areas that require capacity building to improve performance in the TD phase.

Examining how research instruction occurs currently could also shed further light on the issues discussed. Exploring the nature of research courses offered, the breadth of coverage within courses, the classroom activities, and the degree to which courses are learner-centered could all assist in developing a curriculum supportive of TD completion. This study's self-reported TD research needs should also be fully explored using qualitative methodologies such as focus groups or key informant interviews. Qualitative methods may help incorporate respondent perspectives and establish a more comprehensive standpoint regarding research needs and future actions to improve TD completion.

From a methodological perspective, future researchers should consider incorporating both the Witkin (1984) and the Borich (1980) models as complementary tools when assessing training needs in educational settings. The findings from this study imply the use of multiple analytical techniques can help provide triangulation within the data and enhance the robustness of subsequent interpretation of results. In the present study, Borich's (1980) and Witkin's (1984) models confirmed that graduate students in Sub-Saharan Africa lacked sufficient knowledge in TD research areas. If not addressed, lack of research and writing skills will lower masters and PhD completion rates, knowledge creation, graduate supervision quality, and the trained pool for faculty or research positions (Breitenbach, 2019; Elgar & Klein, 2004; Gungea, 2019; Gibbs et al., 2012). Limited graduate students' research competence is a global issue needing attention and cuts across disciplines and forms (Fongwa, 2018; Hagedorn & Ren, 2012; Hayward, 2012; Hayward & Ncayiyana, 2014; Herselman, 2003; Hofmann et al., 2008; Hofmann et al., 2013; Kumi-Yeboah, 2014; O'Clair, 2013; Whitworth et al., 2008). Addressing TD topic areas of

importance and limited knowledge would help train and supply graduate students with the necessary research skills for quality higher learning, meaningful innovations, and enhanced economic growth (Owusu et al., 2017).

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