FROM CHOICE OF CONCEPTS TO DESIGNING STATISTICALLY TESTABLE MODELS: ON THE CENTRALITY OF DEVELOPING CONCEPTUAL FRAMEWORKS IN RESEARCH

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Abstract

The divergence in the application of nomological network of concepts, constructs or variables in the report of conceptual frameworks at different levels of research is a concern to intellectual, skilled, and experienced research scholars. Sometimes, conceptual framework is erroneously reported as a collection of operational definition of concepts or even as a research design. This study is, therefore, in two folds: to x-ray the practical examples of more realistic and statistically testable conceptual models to foster less experienced researchers' knowledge in developing and reporting conceptual framework in research; and to investigate students' abilities in reporting conceptual framework in their research. The study adopted literature review approach with a mixed method design. This study sampled postgraduate (PG) students (N = 21), drawn from a faculty in Nnamdi Azikiwe University from 2019 to 2021, as well as PG students' certified and approved theses/dissertations (N = 125). Observation checklist was used for the quantitative data collection, while a semi-structured interview was used for the qualitative data collection. Percentage was employed to analyze the quantitative data, while thematic analysis was applied for the qualitative data. Reviews demonstrated practical guides and examples of conceptual models. Findings revealed poor students' skills in designing and reporting acceptable conceptual frameworks. Hence, recommendations were made for improvement.

Keywords: Conceptual model, definition of concepts, educational research, interrelations, nomological network

Introduction

To advance knowledge, skills, theory, and practice in vocational and general education, research outcomes are perhaps the most valuable sources of drawing conclusions. Although educational research involves a planned, careful, and systematic study of a phenomenon towards solving a problem to advance theory and practice in any field (Anyakaoha, 2009; Gay et al., 2011), it involves a collection of variables, concepts, or constructs that would be tested to address such a problem. These variables, concepts or constructs are investigated such that their interrelations are quite understood to give a study a meaning. The interrelations of the variables, concepts or constructs

dovetail to a conceptual framework or a conceptual model (Adom et al., 2018; Chukwuedo & Uko-Aviomoh, 2015). Nonetheless, it is sometimes difficult for less experienced and beginning research scholars to determine and design the nomological network of these constructs/variables for a comprehensive study. Hence, poor conceptual frameworks often surface in PG students' thesis and dissertations and other "low level" research publications. Similarly, some researchers tend to avoid the presentation of conceptual framework (Leshem & Trafford, 2007) because of lack of or insufficient knowledge or skills in designing the model; while others tend to argue erroneously on what makes up the model or how the model should be designed in a study. Additionally, there seem to be paucity of research publications or text books that elucidate the approaches to designing a conceptual model in details (Chukwuedo & Uko-Aviomoh, 2015; Eboh, 2007; Leshem & Trafford, 2007). These concerns often create problems in the understanding of the framing of a study and its concepts. This study, therefore, provides valuable insights into the practical steps to understanding and designing a conceptual framework for a study.

Although a concept, a construct and a variable are not exactly the same in research, this paper approximates the three entities as very similar in order facilitate the approach to designing a conceptual model. A conceptual framework is created "when concepts are contextually linked in a research" (Chukwuedo & Uko-Aviomoh, 2015, p.95). It is a schematic description and illustration of the causative mechanism and relationships or interactions deducible from the research problem (Adom et al., 2018; Eboh, 2009; Jabareen, 2009). According to Imenda (2014), a conceptual framework is an end result of bringing together a number of related concepts to explain or predict a given event, or give a broader understanding of the phenomenon of interest or simply, of a research problem. In a nut shell, a conceptual framework should show, with diagram (pictorial), the nexuses of the research variables/concepts/constructs. It should also spell out the context or form of relationships or interactions between phenomena, as well as the process or flow associated with the interactions (Chukwuedo & Uko-Aviomoh, 2015, p.95).

In modelling or designing a conceptual framework for a study, its elements or constituents should include the *(primary) independent or predictor variables, moderator or secondary independent variables, dependent or outcome variables, mediator or intervening variables, and control variables* of the study (e.g., Eboh, 2009; Gotschi et al., 2017). Some other measurable variables that the researcher intends to study can be included in the conceptual model. Sometimes, (but not often), a conceptual framework contains very few unmeasured variables/concepts/constructs in the study; but must directly enhance the understanding of the study's network. However, caution must be exercised in including unmeasured variables/concepts/constructs (a) for a meaningful flow of information while interpreting the framework, (b) to foster the development of hypotheses of the study, or (c) to provide justifiable discussion of the findings of the study. By and large, an ideal or a good conceptual framework has links with the study's theories, objectives, research questions and hypotheses, as well as statistical-analytical pathways and the findings of the study (see Haider et al., 2020; Ogbuanya & Chukwuedo, 2017; Ogbonnaya & Babalola, 2020; Van Wingerden et al., 2017).

Within the context of a study, a conceptual framework can be *designed/developed, adapted or adopted* by the researcher. From the theories so far, this study conceives a conceptual framework as a depiction of *nomological network* of a study's concepts, variables, or constructs that (a) are deducible from the theory(ies) of the study, (b) foster hypotheses development or

formulation, (c) give insights into the design of the study, (d) promote effective discussion of the findings. Although the network can be represented in any form of schematic diagram that depicts the logical reasoning of the study, a path analytical model (e.g. Chukwuedo et al., 2021; Ogbonnaya & Babalola, 2020) is preferable because it helps to design a testable conceptual framework or model, as well as depicts the variables, concepts, or constructs that are appropriately measured in the study. Though a conceptual model may be best represented with a schematic diagram, it may be discussed in prose (without a diagram) but must explicitly describe the perceived network of the concept (c.f., Gotschi et al., 2017; Rocco & Plakhotnik, 2009: Stenbacka & Forsberg, 2020).

The Delusion in Schematic Illustrations of Conceptual Framework versus the Design of a Study

While a research design or design of the study refers to the overall approach employed to incorporate the different aspects of a study, a conceptual model depicts the interrelations among concepts, constructs or variables of the study. In research, there are situations where a researcher may use schematic diagram to represent the research design for a better understanding of the study (e.g., Chukwuedo et al., 2021; Ogbuanya & Chukwuedo, 2017; Ogbuanya et al., 2018; Van Wingerden et al., 2017). However, the use of such diagrams to represent the research design is often misconceived by beginning or less experienced researchers as being a conceptual framework. Whereas the schematic representation of the design of a study gives more details about the research (links the research variables, aspects of its research questions/hypotheses, information about the participants and/or instrument, research process such as experimental procedure, e.t.c.), the schematic diagram of a conceptual framework succinctly depicts the measured variables with little or no emphasis on other unmeasured variables (Rocco & Plakhotnik, 2009; Van Wingerden et al., 2017). There is, therefore, a significant difference between the meaning, content, and schematic representation of conceptual frameworks and research deigns. A research design is not the same as the conceptual model, and as such, the schematic representation of a research design should not be taken as the conceptual framework of the study. Thus, caution must be exercised in adding “junks” to a conceptual model. To design a conceptual model, the researchers hereby made attempt to guide beginning or less experienced researchers on the steps required for such a task:

1. Identify the concepts, constructs and/or variables of the study.
2. Decide and identify the concepts, constructs, or variables to be measured in the study.Then, consider which of the constructs are latent. Where necessary, identify any unmeasured variable,
3. The variables should have brief names - written as a word, few words or codes.
4. Formulate the links between variables or constructs. Ensure you know the variable that leads to the other. Be very sure of the predictor, criterion, moderator, mediator, or control variables.
5. Understand and decide the kinds of shapes (e.g., arrow, text box, rectangle, circle, oval, line, block arrows, callouts, stars, banners, flowcharts, e.t.c.) that will be used to design the diagram.

6. Begin the sketching of the diagram with the desired shapes (e.g., blocks, arrows, ovals, e.t.c.), ensuring that the names/codes of the variables are used. Similarly, illustrations may be attached to the arrows, especially where it is not necessary to use blocks to show such illustrations.
7. The direction of the arrows must be such that it agrees with the theoretical reasoning of the links between the variables.
8. Revise the diagram and ensure its validity by giving it to experts or colleagues for review.

Statement of the Problem

Research (project, thesis or dissertation) is a mandatory requirement for a student's graduation from the undergraduate to doctorate levels. No student is expected to successfully graduate at these levels without meeting the minimum requirements in research. This obligation gives an insight into the importance of research for a student's graduation. Thus, a good student is expected to be able to give a clear framing of their research/study by demonstrating acceptable conceptual framework. Since conceptual frameworks help the researcher to give a study a meaning and enhance the readers' understanding, it is expected that no research (especially quantitative study) should be presented without a conceptual model. Yet, from the researchers' experiences, many students appear to ignore or misconceive the presentation of the conceptual framework in their study. The researchers, therefore, presume that students inability to report conceptual model in their study may be hinged on some inherent factors (e.g., lack of knowledge, not being taught, e.t.c.). This study, therefore, intend to fill the gap by providing exemplary approach to designing and reporting conceptual models, and to determine how PG students' 'precipitate' and report the aspects of conceptual frameworks.

Research Questions

Two research questions were answered in this study.

1. How do PG students' present conceptual framework in their research works?
2. Do PG students' possess the skills in designing and presenting conceptual frameworks in their research works?

Methods

This study (partly a case-study of a faculty in Nnamdi Azikiwe University) is a two-fold research design. First, relevant literature was reviewed to provide a practical guide in designing and reporting conceptual frameworks. Second, the study employed the mixed method design – quantitative and qualitative designs (Creswell, 2014). In this study, the quantitative design involved the collection of data via observational checklist; while the qualitative design involved the collection of data via semi-structured interview. The sample of the study were 125 PG students' theses and dissertations (M.Sc; n = 77, and Ph.D; n = 48) and 21 PG students (M.Sc; n = 7, and Ph.D; n = 14) from a faculty in Nnamdi Azikiwe University, Awka, Anambra State, Nigeria. An observational checklist and a semi-structured interview were used as the instruments for data collection. The checklist consists of seven items with a 2-response option of present (1) and absent (0). The instruments were validated by three experts.

For data collection and reporting, ethical practices were taken into consideration. Although the data were obtained from PG students' completed and certified theses and dissertations from a faculty in Nnamdi Azikiwe University, the researchers did not report the results based on the

faculty or departments in the faculty where the information were obtained because there was no written permission from the faculty or departments to report their identity. In collecting the qualitative data, triangulation was adopted to validate and put the data into a more meaningful context (Kelle et al., 2019). In all, data were collected by the researchers between October 2019 and April 2021. For the qualitative data analysis, thematic analysis was employed (Nowell et al., 2017); while simple percentage was used for the qualitative data analysis.

Results

The results of this study are reported in two aspects – the literature reviewed and self-developed evidence of designing and reporting conceptual frameworks, and the results of the mixed method design.

Exemplifying practical conceptual models

Succinctly, a conceptual framework illustrates what you expect to find through your study - depicts the relevant variables for your study and maps out how the variables might relate to each other. Hence, in this paper (as named by the researchers), practical examples of conceptual model are presented in two classes: ***Class A Models*** - models with measured and unmeasured variables (see Figure 1), and ***Class B Models*** (see Figure 2) - models with measured variables only (e.g., predictor, criterion, moderator, control, and mediator variable). Although the representation of models for both classes are obtainable in research literature, *Class B Models* is herein conceived as better models because the models depict more meaningful framework, reflect more precision about the study, are often verified or statistically tested, give better insights into the structural and measurement models, and promote better writing and understanding of discussion, implication and limitations of a study. Moreso, Class B models that have been tested over time with consensus results can possibly lead to development theories. Now, practical examples of Class A and Class B models are hereby presented.

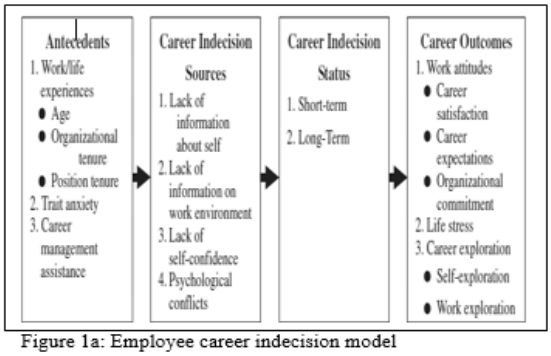

Figure 1a: Employee career indecision model

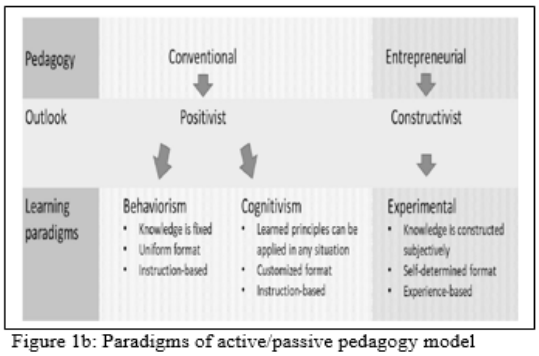

Figure 1b: Paradigms of active/passive pedagogy model

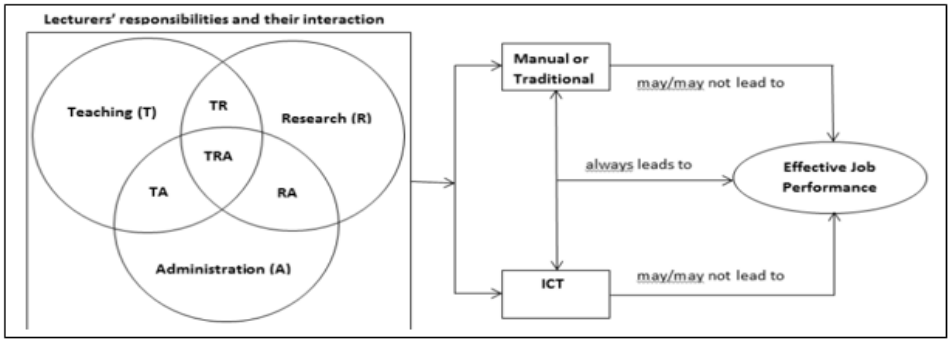

Figure 1c: Lecturers' responsibilities-performance model

Figure 1*. Class A Conceptual Models (All the variables were not measured)*

The models presented in Figure 1 were adopted from previous studies, and are herein categorized as *Class A Models* because the models are made up of variables/constructs that were not measured. Figure 1a is a conceptual model of employee indecision model (Tsai et al., 2017). The study was carried out to develop career anxiety scale for college students. The research established the need to measure students' career anxiety before transisting from school to work. Its hypotheses were derived from potential reasons why employee career indecision increases. The researchers presumed that there are antecedents that lead to indecision which inturn affects career outcomes. Hence, Tsai et al. adopted the employee career indecision model to explain the reason for anxiety scale development for college students. Figure 1b is a model of paradigms underlying passive and active pedagogy (van Ewijk, et al, 2020) which adopted a mixed method approach to investigate the effects of passive and active pedagogy on entrepreneurial intentions. The study theorized its passive and active pedagogy from theories upon which it is hinged. Hence, the conceptual model embedded the theories and related variables and constructs. However, the test of the hypotheses did not directly address all the constructs/variables that appeared in the conceptual model; but the presence of the constructs/variables in the model helped to understand the theories from which passive and active pedagogy were derived.. The model of Figure 1c is a conceptual framework of lecturers' responsibilities-performance model (Chukwuedo & Igbinedion, 2014). The study determined technical and vocational education lecturers needs in the use of ICTs for effective job performance, implicitly taking into account the responsibilities of the lecturers and the interrelation of the responsibilities. Three research

questions were answered in the study but only the variables of ICTs were used to ascertain the opinion of the lecturers as it helps them to perform their duties. Thus, the model was not statistically tested as presented.

For a practical guide on how to report a conceptual model, Figure 1c is used. A researcher may describe the model as follows: The TVE lecturers' responsibilities are basically in three folds (teaching, research, and administrative tasks), hence, there is need to enhance the lecturers' ICT skills for effective job performance. The conceptual framework shows that pairs of responsibilities of the lecturers interact while performing their duties. Although it is possible to perform their jobs without ICT skills, it is presumed that effective job performance can be attained if the lecturers' ICT skills are enhanced. Hence, the need to determine their ICTs capacity building needs.

Note that where hypotheses need to be developed for such a study, it would be better that a detailed theoretical arguement or reasoning is used to theorize the hypotheses in relation to the links in the model; but this illustration is beyond the scope of this study. However, readers may consult the studies used for Class B Models.

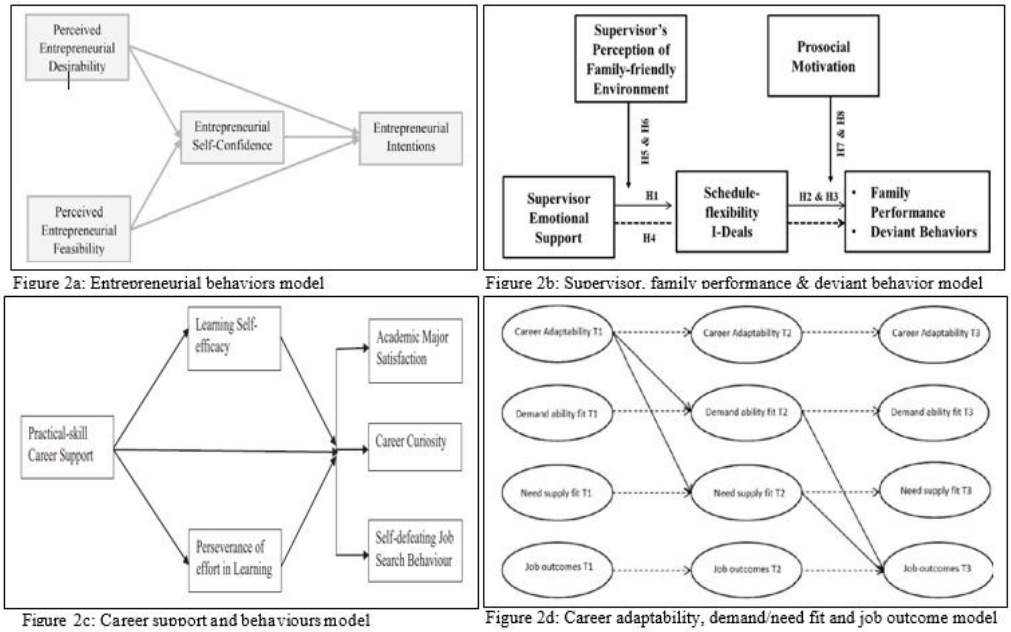

Figure 2*. Class B Conceptual Models (All the variables were measured)*

The models shown in Figure 2 depict conceptual frameworks of studies whereby all the variables in the model were measured. The models are herein termed Class B conceptual models. Figure 2a is a conceptual model that tested hypothesized mediation of the relationship between perceived entrepreneurial desirability and feasibility (predictor variables) and entrepreneurial intentions as the criterion variable via entrepreneurial self-confidence (Otache et al., 2021). The elements of the conceptual framework are tenets of the theories that guided the study, and the development of the hypotheses for the study was discussed in tune with the conceptual model.

The model in Figure 2b depicts a moderated mediation of the association between supervisor emotional support and family performance and deviant behaviours (Kelly et al., 2020). The constituents of the model were derived from the theories that supported the study. In a similar vein, the development of the hypotheses was discussed in relation to the reasoning and design of the model. From the model, schedule flexibility ideals is the mediator variable; while perceived family-friendly environment as well as prosocial motivation serve as the moderator variables. Figure 1c shows the conceptual model of the effect of a practical-skill career support on career behaviours via learning self-efficacy and perseverance of effort in learning such that the variables were measured three times (Chukwuedo & Ogbuanya, 2020). The model is in line with the hypotheses of the study, and its reasoning was hinged on the theories upon which the variables were derived. Finally, Figure 1d represents a conceptual model of the investigation into a-three wave longitudinal study of the relationship between career adaptability and job outcomes via fit perceptions (Kaur & Kaur, 2020). The model showed two approaches of mediation test, and the directions of the model arrows depict the different hypotheses developed for the study.

As a practical guide to reporting a conceptual framework, Figure 1c is used as an example. Hence, a researcher may succinctly report it as follows: Figure 2c shows the conceptual framework of this study. It represents the pathways of the development of the study's research questions and the hypotheses. The model shows that practical-skill career support is the independent or predictor variable, while academic major satisfaction, career curiosity and self-defeating job search behaviour are the dependent or the criterion variable. In this model, learning self-efficacy and perseverance of effort in learning are the mediator variables. Hence, the conceptual framework is a parallel mediation model that test effect of practical skill career support on academic and career outcomes.

Outcome of the quantitative and qualitative investigations

The results are presented in themes, but the quantitative data are presented first, followed with the qualitative data.

Table 1: *Percentage Practices of Conceptual Frameworks Designs in PG Students Theses*

		Ph.D 2019-2021		M.Ed, 2019-2021		Total, 2019-2021	
Sn	**Design Practices of Conceptual Models**	**Present n (%)**	**Absent n (%)**	**Present n (%)**	**Absent n (%)**	**Present n (%)**	**Absent n (%)**
1	Use of definitions of variables, concepts or constructs only	48 (100)	-	77 (100)	-	125 (100)	-
2	Use of schema/diagrams only, to show the nexus of variables, concepts or constructs	7 (14.6)	41 (85.4)	5 (6.5)	72 (93.5)	12 (9.6)	113 (90.4)
3	Use of explanations (without diagram) to demonstrate the	-	48 (100)	-	77 (100)	-	125 (100)

	nexus of variables, concepts or constructs						
4	Application of only items 1 and 2 of this table simultaneously	7(14.6)	41(85.4)	5 (6.5)	72 (93.5)	12 (9.6)	113 (90.4)
5	Application of only items 1 and 3 of this table simultaneously	-	48 (100)	-	77 (100)	-	125 (100)
6	Application of only items 2 and 3 of this table simultaneously	-	48 (100)	-	77 (100)	-	125 (100)
7	Application of items 1, 2 and 3 of this table simultaneously	-	48 (100)	-	77 (100)	-	125 (100)

Table 1 shows the observational results of the approach PG students adopt in the presentation of conceptual framework in their study in a faculty in Nnamdi Azikiwe University. The table shows that majority of the students adopt the approach of a collection of definitions of concepts as a conceptual framework, with very few schematic diagrams. This implies that majority of the research works lack the use of schematic diagrams to represent a conceptual model.

Data was collected for the qualitative design via a semi-structured interview to determine if the results will agree with the quantitative data and to be able to establish 'how' in the research questions of this study. From the semi-structured interview, the following findings emerged:

> I know conceptual framework as definition of concepts that appear in the title of my thesis. First, the definitions should be as I found in previous studies, and then create my own definitions of the concepts as they apply to my study. This is how I know what a conceptual framework is, and that's how I have reported it in my thesis (*MSc Student 5*).
> In my own view, the use of diagram is good but I don't know what and what should be in the diagram. I, therefore, prefer the use of definition of concepts because that is what I know and I think it is good and easier (*Ph.D Student 4*).
>
> I don't have sufficient skills to develop a conceptual model, though I presented it in my Ph.D dissertation with a diagram. I used all the concepts I have in the title of my dissertation and the variables in my hypotheses to design the schema. I also included the research design (pretest posttest quasi-experimental) in the diagram, showing the control and experimental groups (*Ph.D Student 8*).
>
> No one taught me that a conceptual framework involves the use of a model. I thought models are only shown when reporting a theoretical framework. Infact, I did not use any diagram in my work. I just provided definitions of concepts, and then added my own definitions for each concepts I reviewed (*M.Sc Student 1*).

> I have actually seen works that use diagram to show a conceptual framework, but I have always used definition of concepts in my M.Sc and Ph.D works to explain conceptual framework. I actually do not know how to develop the diagram but if I am taught I would use it in my future research (*Ph.D Student 12*).

These reports show that the students have been using a collection of definitions and operational definitions to represent conceptual models. In a similar vein, it can be inferred that the students were not taught how to design a conceptual framework using a schematic diagram. Thus, majority of the students lack the skills in designing and reporting a conceptual framework. Hence, the results are in consensus with the quantitative data.

Discussion of Findings

The outcomes of this study showed that the PG students sampled in this study have erroneously reported conceptual frameworks as collections of operational definitions because they were not rightly guided on the approach to developing conceptual frameworks. It, therefore, implies that the students lack the necessary skills for designing a conceptual framework. Another reason for this lack of skills among the students may be as a result of insufficient publications that properly addressed concerns on conceptual frameworks and then literature could not provide adequate guideline to developing statistcally testable conceptual models. These outcomes agree with the notion of Leshem & Trafford, (2007) who affirmed that conceptual framework is often overlooked in some levels of research. In another perspective, the outcomes of this study have shown that conceptual framework is necessary in every study and should not be misconceived or neglected (Adom et al., 2018; Chukwuedo & Uko-Aviomoh, 2015; Leshem & Trafford, 2007). Similarly, a conceptual framework is better understood, hypothesized and tested if it is schematically presented (c.f. Kaur & Kaur, 2020; Ogbuanya & Chukwuedo, 2017; Otache et al., 2021).

Limitations and Future Research Direction

With keen interest, the researchers of this study acknowledge that the findings of this study are of value. However, the study has some limitations. Since this study is relatively a case study design, caution must be exercised in generalizing the findings to other categories of students in other faculties and institutions. Hence, further studies should be conducted in other institutions to compare the findings about the skills possessed by PG students in developing a conceptual model. It is also important to note that this study focused more on quantitative research in explaning and showing schematic illustrations of conceptual framework. Thus, more studies should be conducted about conceptual framework for qualitative design.

Implications of the Study

The findings of this study have implications for theory and practice. This study has added in the expansion of knowledge on conceptual frameworks. The study has shown practical steps for developing conceptual models. Hence, this study can serve as a resource for research scholars to teach conceptual framework in research and statistics. There is no doubt that this study can help students to develop the fundamental skills in designing conceptual frameworks for their projects, theses or dissertations.

Conclusion

There is obvious insufficient or lack of skills among PG students in developing more meaningful conceptual frameworks for their theses and dissertations. Thus, such lack may hamper the ability of the students to develop better testable hypotheses and develop a comprehensive and meaningful discussion of the findings. In a nutshell, conceptual framework should be properly taught in research to foster appropriate application of theories, developments of hypotheses, selection of appropriate design and statistics, and a more robust discussion of findings.

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