

The Paradigm Shift in Postgraduate Thesis Writing

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Received: 29 May 2019

Published: 18 June 2019

Keywords: *Paradigm Shift; Scientific Revolution; Postgraduate Students; PhD Thesis; Research; Africa*

Abstract

Paradigm shift may be defined as a fundamental change in the basic concepts and experimental practices of a scientific discipline. Paradigm shift is a concept initially propounded by the American physicist and philosopher Thomas Kuhn in 1964. The populist saying is “the only thing that is constant in nature is change.”

Globally, there is obviously a “Paradigm Shift” in thesis writing but several teachers, trainers, mentors and academicians in scientific institutions are unaware of the new order of progress in postgraduate research writing. This article therefore is aimed at informing the readers about this paradigm shift. The role of research writing to our society cannot be overemphasized. The creation of a new approach to research writing especially that of PhD by publication has wide range of benefits yet to be mined by our scientific world. This has far reaching implications to postgraduate students especially in Africa. These Postgraduate students are particularly interested in making significant improvement in their study programs in general. As more African institutions may be considering ‘shifting’ to this format through institutional policy and practice, it becomes imperative to consider whether the format can act as the well - sorted antidote to the ills of high doctoral

dropout rates; low and slow doctoral throughput rates; and the academic isolation doctoral candidates may experience. Several hurdles, however, need to be overcome to harness these gains. There is a wake-up call to all: sundry, government, trainers and academicians to collaborate so that we could make this world a better place through scientific discoveries by research with attendant benefits after all.

Background

Paradigm shift is a concept initially propounded by the American physicist and philosopher Thomas Kuhn, which is defined as a fundamental change in the basic concepts and experimental practices of a scientific discipline. In this context, the word “paradigm” is used in its original Greek meaning, as “example”. Kuhn contrasts paradigm shifts, which characterize a scientific revolution, to the activity of normal science, which he describes as scientific work done within a prevailing framework (or paradigm) [1].

Ever since Thomas Kuhn in 1962 first wrote his most controversial theory of Paradigm shift; the scientific world has remained perplexed by the terminology which is probably the most used - and abused - term in contemporary discussions of organizational change and intellectual progress [2]. About fifty years ago, one of the most influential books of the 20th century was published by the University of Chicago Press. As at this time several notable persons if not most lay people have probably never heard of its author, Thomas Kuhn, or of his book, *The Structure of Scientific Revolutions*, but their thinking has almost certainly been influenced by his ideas. The litmus test is whether you’ve ever heard or used the term “paradigm shift” [2].

The Structure of Scientific Revolutions was first published in 1962; second edition 1970; third edition 1996; fourth edition 2012. It is a book about the history of science by the philosopher Thomas S. Kuhn. This publication remained a landmark event in the history, philosophy, and sociology of scientific knowledge. Kuhn challenged the then prevailing view of progress in “normal science” [3-5]. Normal scientific progress was viewed as “development-by-accumulation” of accepted facts and theories. Kuhn argued for an episodic model in which periods of such conceptual continuity in normal science were interrupted by periods of revolutionary science. The discovery of “anomalies” during revolutions in science leads to new paradigms [3-5]. New paradigms then raise new questions of old data, move beyond the mere “puzzle-solving” of the previous paradigm, and change the rules of the game as well as the “map” directing new research [3-5].

For instance, Kuhn’s analysis of the Copernican Revolution emphasized that, in its beginning, it did not offer more accurate predictions of celestial events, such as planetary positions, than the Ptolemaic system, but instead appealed to some practitioners based on a promise of better, simpler solutions that might be developed at some point in the future [4-6]. Kuhn called the core concepts of an ascendant revolution its “paradigms” and thereby launched this word into widespread analogical use in the second half of the 20th century. Kuhn’s insisted that a paradigm shift was a mixture of sociology, enthusiasm and scientific promise, but not a logically determinate procedure, caused uproar in reaction to his work [3-6].

Table 1: *Examples of paradigm shifts in Natural sciences [2,7-9]*

1543	The transition in cosmology from a Ptolemaic cosmology to a Copernican one.
1543	The acceptance of the work of Andreas Vesalius, whose work <i>De humani corporis fabrica</i> corrected the numerous errors in the previously-held system created by Galen.
1687	The transition in mechanics from Aristotelian mechanics to classical mechanics.
1783	The acceptance of Lavoisier's theory of chemical reactions and combustion in place of phlogiston theory, known as the chemical revolution.
1783	The transition in optics from geometrical optics to physical optics with Augustin-Jean Fresnel's wave theory.
1826	The discovery of hyperbolic geometry.
1859	The revolution in evolution from goal-directed change to Charles Darwin's natural selection.
1880	The germ theory of disease began overtaking Galen's miasma theory.
1905	The development of quantum mechanics, which replaced classical mechanics at microscopic scales.
1887-1905	The transition from the luminiferous aether present in space to electromagnetic radiation in spacetime.
1919	The transition between the worldview of Newtonian gravity and the Einsteinian General Relativity.

Furthermore, Table 1 above is the various examples of paradigm shifts in natural sciences as illustrated by Thomas Kuhn [2,7-9]. Even though this shift was equally demonstrated in the social sciences, for the purpose of this presentation, we only illustrated the paradigm shifts in natural sciences. Kuhn however, addressed concerns in the 1969 postscript to the second edition. For some commentators, "The Structure of Scientific Revolutions" introduced a realistic humanism into the core of science, while for others the nobility of science was tarnished by Kuhn's introduction of an irrational element into the heart of its greatest achievements [3-6]. Consequently, we are experiencing in many spheres today a similar scientific revolution and most importantly in scientific writing. There is also a paucity of information about the paradigm shift in scientific research writing and accentuated criticism in some quarters that such hitherto theory does not exist after all.

Challenges Faced by Postgraduate Research Students

Havenga *et al* [10] studied the challenges experienced by postgraduate research students in South Africa in 2018 and identified personal, institutional and research challenges as did a number of other studies [11-13].

In the Havenga *et al* study, regarding personal challenges, the participants indicated the following challenges: financial, employment, family and accommodation. Perna [10,14] explained that financial constraints are very common and relate to the direct cost of education (e.g. university tuition fees and accumulation of educational debt), the peripheral cost (cost of living away from home) and the inability to earn an income if the postgraduate student is not fully employed at the time. Mutula *et al* [10,15] added that most countries on the African continent do not have funding for postgraduate research. In the study by Cleary *et al* [10,16] the two main reasons for non-completion of doctoral degrees were financial and family stressors.

The postgraduate students in the study also mentioned their frustrations in finding accommodation within the institutional residences. Clerehan *et al* [10,11,17] concur with the participants' challenges and expressed concerns for students finding accommodation. The postgraduate students experienced very high workload at their place of employment, which ultimately affected their study performance. Essa and others [10,12,18] also found that all the participants were working adults who also had other responsibilities, for example family and workplace commitments. These experiences are supported by Essa [10,12] who expounded that balancing of academic, work and family responsibilities is a challenge for postgraduate students who may be employed and have families of their own. Benshoff *et al* added that fulfilling multiple roles, responsibilities and expectations is a common feature of postgraduate studies [10,19].

The educational experiences, mentioned by the participants in this study, comprise high workload with time constraints, inflexible contact sessions, inadequate subject information and limited time for interaction with other students. Barroca *et al* explained that through effective induction, many challenges that arise from misconceptions or inappropriate expectations for these students might be bypassed [10,20].

The postgraduate students' experiences of supervisors being unsupportive, unapproachable and rigid, and having a negative attitude towards them were expressed by the participants in this study. Similarly, Essa [10,12] and Clerehan *et al* [10,11] found that many postgraduate students felt that the lecturers were distant, inaccessible, unapproachable and abrupt and this seemed to be the case whether the students stayed in the same or a different province than where the institution was located. Frischer and Larsson [10,21] and Wadesango and Machingambi [10,22] concur with the importance of support by explaining that the supervisor-supervisee relationship is central to progress and completion.

Aim of This Article

This is aimed to enlighten teachers, trainees, trainers, mentors and academicians in scientific institutions on the "Paradigm Shift" in Thesis writing.

Approaches to Research Writing [23-27]

In accordance with Thomas Kuhn's concept, the Paradigm Shift in Thesis writing can be explained as the existence of two different approaches to Research Thesis or Dissertation writing evolving. These include:

1. The Traditional Thesis or Monograph approach
2. The Modern Thesis or PhD Thesis by publication approach

The Traditional Thesis or Monograph Approach which conceptually can be regarded as "normal science" of Thomas Kuhn's concept; consists of a research topic or title in which the body of work is built into: Abstract, Introduction or Background, Review of Literature, Methodology, Results, Discussion and Conclusion as well as references [23-27].

The Modern Thesis or PhD Thesis by Publication Approach which is otherwise viewed as "normal scientific progress" is currently being adopted by several Scandinavian States like Norway, Finland etc. and many foreign Universities nowadays [23-27].

Historically, this shift towards PhD by publication began in the early 1990s. According to Breimer and Mikhailidis [28,29], “A responsible scholar forms part of a scholarly community and the initiation into this community primarily takes place through doctoral studies” [28,29]. It would therefore be possible to argue that a PhD by publication as a form follows the functions of developing expert, responsible scholars and integrating them into the discourse of the disciplinary community, a notion which is supported by Breimer and Mikhailidis [28,29]. As such, the PhD by publication has become the norm in many countries, particularly in the Global North, and specifically within the science, technology, engineering and mathematics (STEM) disciplines [28,29].

The approach allows the young scientist or researcher to write along a Major Title or Topic. Then serial chapters which individually will be a continuation of the main title which subsequently could be adopted later on as separate paper work. Since the PhD or MSc (Postgraduate research) student is still developing himself in the act of writing is permitted to use a previously published paper as a guide to the writing of each chapter. The thesis has an introductory chapter which is introducing the whole research paper; the main body of the thesis consists of several independent chapters but a continuation of the main topic and a conclusion chapter which invariably is summarizing the entire work. By the end of the thesis approval one can adopt each independent chapter as an individual paper and can be submitted for publication as separate papers [23-27].

This is essentially what the thesis by publication is all about. This does not in any way undermine the integrity or depth of knowledge of the research work.

Core Concepts of PhD Thesis by Publication

The “PhD by Publication” is an alternative to the traditional “PhD by Monograph” approach. In a PhD by Monograph, the PhD student writes a comprehensive piece of research in a book form, with separate chapters for literature review, conceptual development, analyses, and conclusions. The monograph approach is more in line with a view of demonstrating broad knowledge. Traditionally, only once the PhD thesis is completed, an attempt is made to carve out one or more research articles, which are then submitted to academic journals [30].

In a PhD by Publication, the PhD student authors or co-authors multiple articles, which are subsequently joined together to produce the PhD thesis. Each article will have the typical set up for the field, most frequently with sections for literature review, conceptual development, analyses, and discussion. The “PhD by Publication” model is an option for those doctoral candidates seeking to develop skills in writing articles for submission to peer reviewed journals during their PhD enrolment [30].

A “PhD by Publication” teaches the PhD student the skills that are required for a modern academic: being able to write impactful and innovative research articles that are concise and clear, and being able to navigate the review process. For instance, the leading business schools in Europe, Asia, and North America have adopted a PhD by Publication system [30].

Key Differences

There are four key differences between a PhD by Publication and a PhD by Monograph:

1. The Outcome: A monograph will typically have more detail in each of the chapters (e.g., a more elaborate literature review, more detail on the analyses, lengthier discussion). In contrast, the PhD by Publication will be typically more concise, because academic journals demand parsimony in writing. Hence each chapter in this kind of thesis will look like a rather concise, but stand-alone research article [30].

2. The Process: In a PhD by Monograph, the supervision tends to be more at a distance; the idea is that each PhD student should show their own mastery of the subject through mostly independently-conducted research. In a PhD by Publication, the supervision is more of the nature of a master (supervisor) and apprentice (PhD student). The PhD student still takes the lead in the whole research process but obtains rather direct supervision to ensure that the resulting working paper is worthy of being submitted to an academic journal. In the course of the PhD process, the supervision may get less tight to stimulate the development of the PhD student as an independent academic researcher [30].

3. The Design: The differences in the design can be illustrated as below [30]:

In a PhD by Monograph, for instance the Research Topic can be “Acute appendicitis in a tropical African Population”- therefore the authors write on [31]

- a. Abstract- Summarizing the entire research thesis work on the topic,
- b. Introduction or Background: The hypothesis, scientific questions, justifications and scope of the study culminating in main objective and specific objectives of the study which relates to the acute appendicitis especially in a tropical African population.
- c. Review of Literature: Comprehensive review of the literature on the topic.
- d. Methodology: this covers the study design, study setting, sample size calculation, scientific method, and statistical analysis.
- e. Results
- f. Discussion and
- g. Conclusion as well as
- h. References.

Whereas in a PhD by Publication, the chapters are essentially articles that can be written in the format below; using a contemporary example from my PhD Thesis by publication approach. The Choice title for the Thesis or Dissertation is “Acute Appendicitis In A Tropical African Population.” [31]:

Outline of this Thesis (“Acute Appendicitis In A Tropical African Population.”) [31]

Chapter 1: General Introduction and Outline of the Thesis- as the introductory chapter.

In this chapter, the optimal method to diagnose and treat acute appendicitis has been topic of much debate during the past century. Particularly in the past two decades, introduction of diagnostic modalities such as

helical Computed Tomography (CT) and laparoscopy and wider application of laparoscopic appendectomy have created an abundance of clinical studies.

Chapter 2: Diagnosis and Treatment of Acute Appendicitis -Through the years: [a meta-analysis]. This chapter includes a literature review to answer two key questions: What is the current state of the art diagnosis and treatment of acute appendicitis?

What evidence can be culled to support different diagnostic and treatment modalities?

CT yields a high accuracy for acute appendicitis. This factor combined with the increasing availability of helical CT scanners has resulted in a wide application of this diagnostic procedure. However, enteral and intravenous contrast enhancement is often considered to be mandatory to establish high accuracy.

Chapter 3: Ultrasound Scan in the evaluation of Acute Appendicitis in the Tropics: [Clinical research] - examines the role of ultrasonography studies in acute appendicitis in the tropical population (Nigeria, Cameroon etc.). In this chapter, the question is answered:

Can Ultrasonographic Scan (US) be used as a diagnostic tool in patients with suspected acute appendicitis in the Tropical population?

The implementation of routine Sonographic scanning in patients with acute appendicitis requires 24 hours radiological expertise because these patients present at any time of day and they require prompt and accurate diagnosis and treatment. Consequently, the assessment of patients with suspected acute appendicitis and interpretation of US and CT scans are done by in house staff.

Chapter 4: Interobserver variability in Sonography for Suspected Acute Appendicitis: [Clinical research]. This chapter addresses the following question: What is the impact of experience of Sonologists on accuracy of US scanning in patients with suspected acute appendicitis? The diagnostic accuracy and treatment of acute appendicitis have undergone major changes as well. The removal of the inflamed appendix is obviously still the goal, but the technique has changed with the introduction of minimally invasive techniques in general surgery reinforcing the need also for early diagnostic tool and in low resource setting like ours, USS remains the vital tool.

Chapter 5: Epidemiologic features of Appendicitis in the Tropics [Clinical research]. In this chapter, the epidemiology and sociodemographics of acute appendicitis is described, based on an observational study.

Chapter 6: Clinicopathological review of Appendectomy specimen in a Tropical Tertiary Hospital: [Clinical research]. In this chapter, the histopathological pattern of the appendectomy specimen was evaluated.

Chapter 7: Laparoscopic Appendectomy in a Tropical African Tertiary Hospital: [Clinical research]. This chapter describes the growing trend towards development of laparoscopic appendectomy in the developing countries.

Chapter 8: Summary and Implication of the thesis. This chapter presents a general discussion and summarizes the findings of the thesis.

Each of the clinical research chapters as illustrated above still takes the typical format of paper article writing of -Abstract, Background, Method, Results, Discussion, Conclusion and References.

4. The Implications for the “Pipeline” of PhD Students (By the End of the PhD Project): Whereas in a PhD by Publication, the chapters are essentially articles of a publishable standard for quality academic journals (and some of them may have been published already), in a PhD by Monograph the “article pipeline” for PhD by Monograph is typically ‘empty’. This means following the huge PhD project; the chances of a publishable article in a timely manner is low. This may have important consequences for the PhD student on the job market if an academic career is the objective [26,27,30].

It is important to note that PhD by Publication is not an approach that will necessarily suit all candidates, all disciplines, or all supervisors, as it does place additional demands on the candidate and supervisors to prepare and submit material for publication. It is possibly harder to write a PhD by Publication, because every word count, and the research must have the potential to be approved by peer reviewers in the field. Undertaking a PhD by Publication requires:

- a) “Stronger than average” ability and motivation of a PhD candidate and
- b) “Stronger than average” support of the supervision panel from the point of acceptance of the PhD application through to the thesis completion.

Whether or not both parties are prepared to follow this approach can be reconsidered at the confirmation.

It should also be noted that the requirements for the “PhD by Publication” can vary by faculty or institutions [26,27,31]. Interestingly, this could be the purpose of a prospective study to investigate the current state of medical universities or countries worldwide; especially in settings where the “PhD by Publication” is already the norm.

A Practical Experience with Doctoral Thesis by Publication [31]

BJA (the first author) experience with PhD Thesis by publication is summarized as follows. This article will be incomplete without a retrospective review of my personal experience with PhD Thesis by publication. As a matter of fact, I consider myself fortunate to have been part of a PhD Thesis by publication process, as I truly benefitted significantly from completing my PhD Thesis by publication. Given the increasing national and international debates on the topic, I find myself reflecting upon my own experiences in this respect. Let me start by providing my audience the background to my doctoral journey. By the time I reached the decision to pursue this PhD Thesis by publication approach, I had completed two Bachelor degrees; a) Bachelor of Science degree in Physiology and b) Bachelor of Medicine and Surgery and then a postgraduate residency training fellowship degree in Surgery (General Surgery). Interestingly, as a requirement for the completion of my fellowship program in General Surgery; I had to do a Postgraduate-Thesis by Monograph approach. The Thesis or Dissertation was entitled “A Comparison of Skin Staplers and Nylon Sutures for Surgical Wound Closure in the Divisions of General Surgery at University College Hospital, Ibadan, Nigeria.” The project was supervised by Professor O.M Oluwatosin and Professor T.O Ogundiran, both of the Department of

Surgery, University College Hospital, Ibadan-Nigeria. The project was subsequently accepted by National Postgraduate Medical College of Nigeria in November 2016.

For me going through this pathway was no fun fare at all because there was no background experience in PhD Thesis by publication. However, before I secured my admission for the PhD program and was preparing to consider the choice of a research topic entitled “Acute appendicitis in a tropical African population”; I browsed the internet and behold I got some interesting papers that proved to me that the PhD by Publication would ultimately make me the dream academic scholar I truly love to be. This article motivated my interest in the choice of PhD Thesis by publication till date. For me also, this decision was not an easy one at all. The challenges at onset of my PhD program were enormous with fifteen major course works and three research papers; there were no guarantees of success - the eventual doctoral thesis or dissertation had to be examined by a new examination panel in Bircham International University whose task it was to consider the work on a doctoral level and who ultimately were not freely disposed to my new style. Perhaps they might not have been very familiar with the PhD by publication format, which put my Thesis on the firing line. I was even requested at a time to re-consider other project titles especially a monograph approach. I carefully recalled my gains and succeeded eventually to convince my examiners to grant my prayer of going ahead with the then on-going project which turned out to be a blessing in disguise.

Consequently, I have not regretted my decision till date because I already published three major chapters of my PhD Thesis by publication and the process had equally strengthened my writing skills and prepared me ready to face the challenges associated with submissions to International Journals.

Furthermore, this is the background and reason for this paper as a way to educating our postgraduate students in Cameroon, Nigeria etc., and Africa in general. Providing also a panacea to enlighten teachers, trainers, mentors and academicians in scientific institutions on the concept of “Paradigm Shift” in Thesis writing; especially the gains inherent in the PhD Thesis by publication approach.

The Undisputable Milestones

Some critics of scientific revolution also argue that there are scientific facts, hypothesis or theory that has also stood the test of time [32-34]. These landmark discoveries are otherwise referred to as undisputable milestones. For instance, let us consider the popular aphorism like “do not let the sun set on acute bowel obstruction.” This aphorism invariably talks about early and prompt management of acute intestinal obstruction that must be done by attending clinician to avert severe lethal complications if one delays the interventions and allows the sun to set over the bowel obstruction [35-42]. Similarly, a gall-stone therefore has been well defined by Moynihan as “a tombstone erected to the evil memory of the germ which lies dead within it” [43,44].

In accordance with these theorists who silently critique the modernist ideas, the same principle applies therefore to thesis writing, which suggest that despite the emerging modern approach, certain attributes of thesis writing remain unbeatable till date. The structures of a research project from ages past remain essentially the same, and therefore commonly presented as: Abstract, Background or Introduction, Methodology, Discussion, Conclusion and References among others.

Contemporary Evidence Based Publication-Oriented Doctoral Pedagogy (Frick *et al*) [45]

According to Frick [45], in her critical appraisal of PhD by Publication -Panacea or Paralysis?; that says *“as more African institutions are considering formalizing this format through institutional policy and practice, it becomes necessary to consider whether the format can act as the panacea to the ills of high doctoral dropout rates; low and slow doctoral throughput rates; and the academic isolation doctoral candidates may experience.”*

In this Frick study [45], the obvious is the contemporary evidence-based practices from a few countries which demonstrate that when pedagogical conditions fostering doctoral publication are created, both students and supervisors may benefit. Citing example from a national study among all eight New Zealand public universities, Sutherland, Wilson and Williams [46] found that early career academics were more likely to be successful in all scholarly facets if they had published during their doctoral studies. In agreement with this finding Breimer and Mikhailidis [29] found that candidates in medicine who completed publication-based theses had significantly higher profiles in terms of their key authorship positions. In addition, Aitchison *et al* [47] found that highly successful supervisors in various Australian universities integrate writing for publication with writing the dissertation by planning a publication program which dovetails with the dissertation itself. These supervisors sought reviewer comment as an explicit strategy for helping students to develop their academic writing, and in turn, the students benefitted from credentialed feedback. In such cases external peer review is often seen as the ultimate and supervisors benefit from an expanded circle of readers who take on a ghost supervisory role, so to say. The article produced furthermore becomes substantive work for the eventual dissertation. Frick also submitted that there is further evidence where supervisors particularly in the natural sciences use this format to develop doctoral students' creativity. What is clearly perceived against this background, therefore, is that the PhD by publication seems like a win-win format. Studies from these countries in the preceding context have demonstrated to us practical examples of good practice. What needs to be put in place to support the PhD by publication? What does a publication-oriented doctoral pedagogy look like?

Lee [48] in answer to these questions, proffers ways in which such spaces and opportunities may be created to include: doctoral seminars; writing groups (Aitchison; [49] Paré [50]); writing retreats (Murray) [51]; and working paper collections (Casanave)[52]. Thus, there is much groundwork to be done before submission, and the supervisors have the primary responsibility for supporting students throughout this process - from what Paré [50] calls their initial “textoids” to eventually publishable material.

In addition, Lee [48] identifies eight pedagogical elements that are needed from the onset to support doctoral publication as demonstrated in Figure 1.

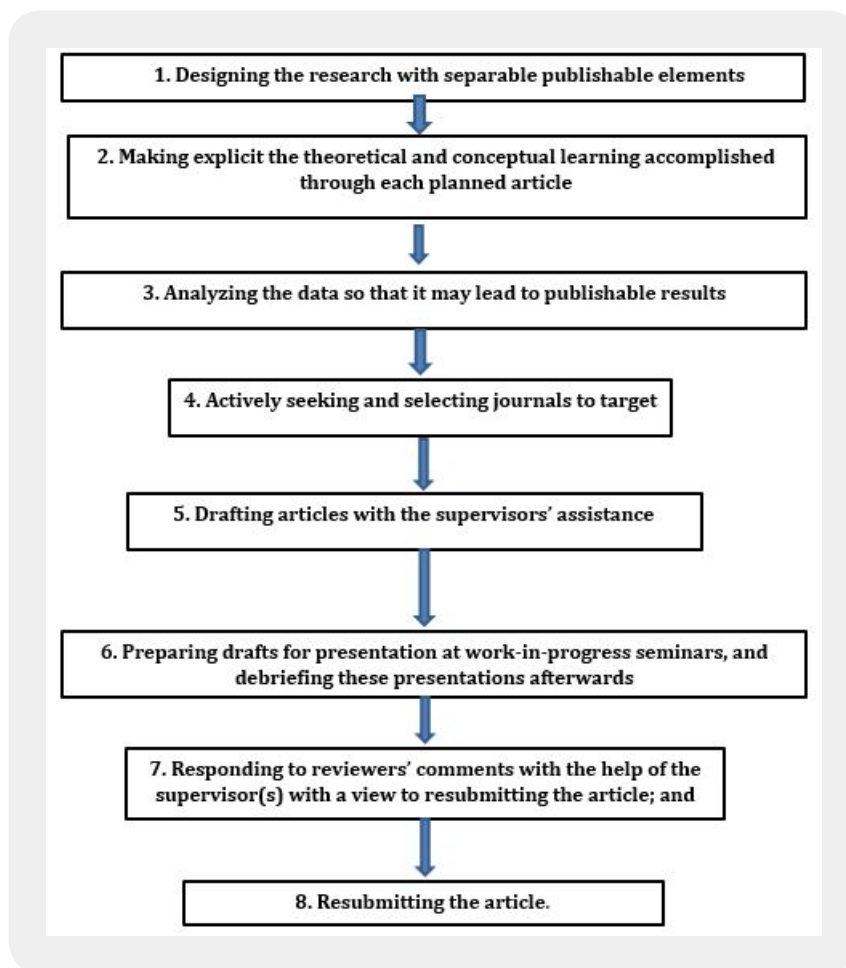


Figure 1: Pedagogical pillars (flowchart) for publication-oriented doctoral programs (lee et al) [48]

Conclusion

The role of research writing to our society cannot be overemphasized. The creation of a new approach to research writing especially that of PhD by publication has wide range of benefits yet to be mined by our scientific world. This has far reaching implications to postgraduate students especially in Africa; many who are seeking progressive improvement in their study programs in general. As more African institutions may be considering 'shifting' to this format through institutional policy and practice, it becomes necessary to consider whether the format can act as the well - sorted antidote to the ills of high doctoral dropout rates; low and slow doctoral throughput rates; and the academic isolation doctoral candidates may experience. Several hurdles, however, need to be overcome to harness these gains. There is a wake-up call to all: sundry, government, trainers and academicians to collaborate so that we could make this world a better place through scientific discoveries by research.

Limitations

1. Ignorance on the part of post-graduate students that “*there is obviously a Paradigm Shift in Thesis writing.*”
2. Several Teachers, Trainers, Mentors and authorities in scientific institutions globally are still very ignorant about the Core Concepts of PhD by Publication therefore may be unable to adopt such in assessment of students.
3. Tardiness or complete refusal on the part of the Teachers or Trainers to accept that PhD by Publication approach to thesis writing is beneficial.
4. Lack of infrastructures and equipment to support quality research in our training institutions.
5. Lack of political will by Government and policy makers to support research at postgraduate level in our training institutions in African in general.
6. Lack of interest in research by our postgraduate students.

Recommendations

1. Training the Trainers courses for PhD by Publication approach to thesis writing in all our postgraduate institutions especially African in general.
2. Training courses for the Postgraduate students on PhD by Publication approach to thesis writing in all our postgraduate institutions especially African in general.
3. Educating the policy makers on the value of research to the community and nation at large.
4. Addressing the political will of the government towards infrastructure and provision of adequate support for research in our postgraduate training institutions especially in Africa.
5. Creating enabling environment to stimulating interest in research works among students at all level through scholarships and sponsorships etc.
6. There is also need to encourage upcoming young researchers especially in Africa at large to conduct further on the impact of PhD by Publication so as to increase the number of respondents to making this research topic more valid.
7. Finally, there is a strong need for a multi-centered prospective study to investigate the impact of PhD by Publication as compared to PhD by Monograph on the outcome of the scientists' career.

Declarations

Acknowledgements: Not applicable

Funding: No record of funding for this research article declared.

Availability of Data and Materials: All data generated or analyzed during this study are readily available from the Corresponding Author.

Disclosures: The Authors have no financial or non-financial disclosures

Authors' Contributions: The Authors conceived the study and participated in its design and coordination as well as helped to draft the manuscript; the authors also read and approved the final manuscript.

Ethics Approval and Consent to Participate: Not Applicable

Informed Consent: Not applicable

Competing Interests: The authors declare that they have no competing interests.

Consent for Publication: Yes

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