Chapter 1
Addressing Curriculum Gaps to Enhance Research Engagement Among Postgraduate Students in Low Resource Settings

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ABSTRACT

For any country to develop, it should be able to conduct research to generate knowledge necessary to solve problems of humanity by producing necessary goods and services. Research is essential for any nation's success. Most goods and services consumed today are products of research conducted in developed countries by post-graduate students. Unfortunately, most post-graduate students in developing countries face a lot of challenges that limit their ability to engage in original research that should be published in refereed journals and to acquire necessary patents accordingly. Curriculum gaps inhibit most graduate students in low-resource settings from engaging in productive research necessary to transform the developing country's economy. Hence, the chapter discusses the importance of research engagement and strategies to fill curriculum gaps in the postgraduate programs to enhance research engagement among the post-graduate students in low-resource settings.

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INTRODUCTION

The human race has succeeded in controlling and managing the rest of other animals on this planet mainly due to its ability to conceptualize and produce theories via the complex language. This is possible because human beings have the ability to think in an abstract way and then operate in concrete terms to change/improve their environment. Hence, the ability of human beings to think in an abstract way is the foundation of research and production of new knowledge.

Historically, human beings used to depend on revealed and authoritative knowledge. However, these types of knowledge were limited and unreliable to solve the real problems that faced the human race. This is one of the reasons why the Roman Empire collapsed. Therefore, training the adequate work force that can engage in quality research is essential for any country. However, many developing countries lack the necessary resources required to train the competitive post-graduate students that can engage in productive research solve the problems/challenges facing their society. This is due to the existing curriculum gaps in most of the post-graduate programs. Hence, this chapter discusses the curriculum gaps in low resource settings post-graduate programs and the strategies needed to address the gaps to enhance research engagement among post-graduate students in the low resource institutions.

The author strongly believes that the strategies discussed in this chapter, if successfully utilized, will go a long way to improve the quality of post-graduate students in developing countries. The postgraduate students will be able to think critically, read analytically and write clearly. This in turn will improve the quality of research engagement and knowledge generations in these countries and hence help to solve the problems/challenges facing these countries. Consequently, more goods and services will be produced so that the human race is able to live a happy and successful life on this mother planet earth.

BACKGROUND

What is a Curriculum?

There are several definitions of the word "Curriculum," none of which seems to be universally acceptable. These definitions have been criticized as either too narrow or to broad, depending on the purpose which the definition is serving. The narrow definitions of the word Curriculum include reference to the following: syllabus, list of subjects, course of study, topics, items of knowledge to be covered, content, organization of teaching and learning methods, time tables, etc. All these are ingredients of a curriculum. However, a curriculum is much wider and transcends

the boundary of the classrooms of schools. The word "curriculum" originates from the Latin word "*currere*" which means a race-course, a track followed by the racing horses (Bishop, 1994). Some wider definitions of curriculum include the following:

- Curriculum is the sum total of all the experiences a pupil undergoes (Bishop, 1985).
- It is all the learning which is planned and guided by the school, whether it is carried on in groups or individually, inside or outside the school (Kelly, 1999).
- Curriculum is the total effort of the school to bring about desired outcomes in school and out of school (Stenhouse, 1975).

The author thinks that a Curriculum is the software of the education system.

Generally, a curriculum should have clear goals/aims, objectives, learning outcomes, content, learning experiences, methods of delivery/instruction strategies, and assessment strategies. Hence, a curriculum is the software or DNA (Deoxy Nucleic Acid) of any education system/teaching-learning program. If there is a gap between the intended curriculum goals/aims and the actual achieved goals/aims, then there exist a curriculum gap accordingly. In other words, a curriculum gap is the difference between the intended learning outcomes and the actual learning outcomes. For instance, in case of post-graduate programs, we expect the graduate students to be able to conduct quality research after completing their studies.

However, many postgraduate students in developing countries commit extensive plagiarism in their dissertations because they are unable to conceptualize original research problems. This is an evidence of a curriculum gap in our postgraduate programs. Therefore, any curriculum gap may lead to a deformed or dysfunctional education system. This is observed in lack of essential knowledge, skills, and values of the products of the teaching-learning programs, and hence a dysfunctional society with many products of the education system unable to solve their day-to-day problems. The same analogy applies in ICT (Information and Communication Technology) when the software is dysfunctional or attacked by a virus, or in the biological system when some changes in DNA may lead to cancerous cells or deformed organism accordingly. For example, sickle cell disease is caused by the abnormal gene that leads to the production of abnormal red blood cells.

Hence, to address such curriculum gaps, the post-graduate students are expected to engage in learning experiences that will enable them to think critically and creatively, read analytically, and write clearly. However, most postgraduate students in low resource settings face many challenges that inhibit them to engage in productive research, lack qualified staff to teach research method courses, lack updated literature, and face poor quality of internet services. Therefore, there is an

urgent need to utilize the necessary strategies to help postgraduate students in low resource settings engage in quality and productive research to solve the challenges/problems facing their societies. This will go a long way to reduce the gap between the developing and developed countries.

CURRICULUM GAPS IN POSTGRADAUTE PROGRAMS IN LOW RESOURCE SETTINGS

Most post graduate programs in low resource settings are characterized by curriculum gaps in terms of the inputs, process, and outputs. For example, most universities in developing countries lack adequate qualified staff, latest literature (textbooks, journal articles, etc.), reliable internet services, and adequate teaching/learning technology in their classrooms. This leads to the dependence most postgraduate students have on lecturers and handouts (printed lecture notes from their lecturers) instead of training in the skills of investigation required to engage in quality research.

Most of the learners learn through lecture method, where the lecturers stand in front and deliver the lecture. The students then passively write the notes. This makes many postgraduate programs appear more like primary/elementary education. Also, the nature of assessment does not focus at high level of learning, that is, analysis, thesis, and evaluations instead they focus on lower level of learning, that is, basic knowledge, comprehension, and some application. This type of assessment is inadequate, and produces graduates that are unable to engage in critical and analytical thinking. Hence, they will not be able to conceptualize original research in order to come up with visible research proposals. As a result, most postgraduate students decide to plagiarize the research topics and dissertations of other scholars.

All in all, due to the curriculum gaps in low resource settings, the post graduate programs in developing countries end up producing graduate students that are unable to conceptualize and conduct original research. This is because most postgraduate students lack essentials skills like critical and creative thinking, analytical reading and analytical writing that are essential for them to engage in research. This constitutes further evidence of the curriculum gap in post-graduate programs.

IMPORTANCE OF RESEARCH IN POSTGRADUATE PROGRAMS

The report of the visitation committee on Makerere University (2017) notes that research and innovations are core activity in any university. The main difference between high school education and university education is that, learners in high

school are given the existing knowledge, whereas university students especially postgraduate students are expected to generate new knowledge by engaging in original research. This necessitates that postgraduate courses be conducted in such manner as to engage the students in critical thinking, analytical reading, analytical writing and skillful presentation to colleagues.

In other words, students should be engaged in science practices like

- Asking questions
- Planning and carrying out investigation
- Analyzing and interpreting data
- Developing and using models
- Engaging in augments from evidence
- Constructing explanations (for science) and designing solutions (for engineering)
- Obtaining, evaluating and communicating information
- Using mathematics and computational thinking (Framework for K12 Science Education, NRC, 2012)

The above science practices are essential to help postgraduate students engage in research so that they are able to produce useful original knowledge necessary to solve the problems facing the community. Research engagement is important because it helps the postgraduate students to develop into scholars that are able to criticize and improve the existing knowledge. Research engagement helps postgraduate students to develop emotionally and socially because they are able to practice the necessary social skills when collecting data, analyzing data, and writing research reports / paper for conferences, and presenting their findings in international conferences. It also helps postgraduate students to learn how to plan their studies, and manage human and financial resources.

CHALLENGES POSTGRADUATE STUDENTS FACE IN LOW RESOURCE SETTINGS

Most postgraduate students in low resource settings lack the necessary facilities to engage in productive original research. Most of the universities lack the latest textbooks, qualified staff, conducive classroom environment, and reliable internet facilities. This makes many postgraduate students in low resource settings unable

to exploit their full potential by engaging in the critical research. As a result, many post-graduate students resort to plagiarism of research reports by copying and pasting any related literature. This is because most of the postgraduate students cannot purchase the latest literature/journal articles that cost about forty United States dollars per article.

Also since there are limited number of qualified staff in most of the low resource setting institutions, the supervisor to student ration ratio is too low. For instance, you may find one professor supervising about twenty (20) postgraduate students in addition to teaching in more than one university. This has led to inefficiency of the professors concerned and frustration on the part of students because the professors are unable to create quality time to help them to appropriately focus their research proposals. Then the students may resort to either hiring research consultants to help them write the research proposal and report or plagiarize research reports. Unfortunately, most of the universities in developing countries lack the updated software to detect the plagiarized proposal/report, and also the professors are too busy to detect plagiarized dissertations presented by postgraduate students.

STRATEGIES TO ADDRESS CURRICULUM GAPS TO ENHANCE RESEARCH ENGAGEMENT AMONG POST GRADUATE STUDENTS IN LOW RESOURCE SETTINGS

In the above sections, the author discusses the curriculum gaps and challenges like lack of essential literature, poor teaching-learning facilities, and unreliable internet services among many others, that postgraduate students face in low resource settings. Below are some of the strategies the author thinks should be utilized to address curriculum gaps to enhance research engagement among post-graduate students in low resource settings. The authors believe that there is an urgent need to adopt the 21st century curriculum and constructivism approaches in all the postgraduate programs.

Integrate the 21st Century Skills in the Postgraduate Programs

In 2007, the National Academies held the *Workshop on Research Evidence related to Future Skills Demands* (Araceli Ruiz-Primo, 2009). The research discussed at that workshop highlighted five broad skills that appear valuable across a range of jobs, from low-wage service work to professional work: adaptability, complex communication/social skills, non-routine problem solving, self-management/self-development, and system thinking.

The five 21st century skills were adapted from a set of six broad competencies initially proposed by Houston (2007), of which two (self-management and self-development) were collapsed into one. Hilton (2008) defined the five competencies from the workshop as follows:

i) **Adaptability**

The ability and willingness to cope with uncertain, new, and rapidly-changing conditions on the job, including responding effectively to emergencies or situations of crisis and learning new tasks, technologies, and procedures. Adaptability also includes handling work-stress, adapting to different personalities, communication styles, and cultures, and physical adaptability to various indoor or outdoor work environments.

ii) **Complex Communications/Social Skills**

Skills in processing and interpreting both verbal and non-verbal information from others in order to respond appropriately. A skilled communicator is able to select key pieces of a complex idea to express in words, sounds, and images, in order to build shared understanding. Skilled communicators negotiate positive outcomes with customers, subordinates and supervisors through social perceptiveness, persuasion, negotiation, instructing, and service orientation.

iii) **Non-Routine Problem Solving**

A skilled problem-solver uses expert thinking to examine a broad span of information, recognize patterns, and narrow the information to reach a diagnosis of the problem. Moving beyond diagnosis to a solution requires knowledge of how the information is linked conceptually and involves metacognition – the ability to reflect on whether a problem-solving strategy is working, and to switch to another strategy if the current strategy is not working. It includes creativity to generate new and innovative solutions, integrating seemingly unrelated information and entertaining possibilities others may miss.

iv) **Self-Management/Self-Development**

Self-management skills include the ability to work remotely, in virtual teams; to work autonomously; and to be self-motivating and self-monitoring. One aspect of self-management is the willingness and ability to acquire new information and skills related to work.

v) **System Thinking**

This refers to the ability to understand how an entire system works, how an action, change, or malfunction in one part of the system affects the rest of the system, and adopting a "big picture" perspective on work. It includes judgment and decision-making, system analysis and system evaluation as well as abstract reasoning about how the different elements of a work process interact.

There is an urgent need to have activities that help postgraduate students develop the above 21st century skills so that they will be able to engage in productive and original research.

"School", "Teacher", "Learner" and "Curriculum" for the 21st Century

How should education be structured to meet the needs of students in this 21st century world? How do we define "school," "teacher," "learner," and "curriculum"?

Schools in the 21st Century are faced with project-based curriculum for life aimed at engaging students in addressing real world problems, important issues to humanity, and questions that matter.

This is a dramatic departure from the factory-model education of the past. It is abandonment, finally of textbook-driven, teacher-centered paper-and-pencil schooling. It means a new way of understanding the concept of "knowledge" and a new definition of the educated person. A new way of designing and delivering the curriculum is hence required.

The following definition for "school", "teacher", "learner" appropriate for the 21st Century were obtained from (21st Century Education, n.d.):

- *School* will go from 'buildings' to 'nerve centres' with walls that are porous and transparent, connecting teachers, students and the community to the wealth of knowledge that exists in the world.
- *Teacher* from primary role as a dispenser of information to orchestrator of learning and *helping out students turn information into knowledge, and knowledge into wisdom.*

N.B. The 21st century require knowledge generation, not just information delivery, and schools will need to create a "*culture of inquiry*".

- *Learner*: In the past, a learner was a young person who went to school, spent a specified amount of time in certain courses, received passing grades and graduated. Today, we must see learners in a new context. First, we must

Table 1.

	20th Century Classroom	21st Century Classroom
1.	Time-based	Outcome-based
2.	Focus: Memorization of discrete facts.	Focus: Students know, can do, and after assessment, all the details are forgotten.
3.	Lesson focus on the lower level of Bloom's Taxonomy – knowledge, comprehension and application.	Learning is designed on upper levels of Bloom's taxonomy – Synthesis, analysis and evaluation (and include lower levels as curriculum is designed down from the top).
4.	Textbook driven.	Research driven.
5.	Passive learning.	Active learning.
6.	Learners work in isolation – classroom within four walls.	Learners work collaboratively with classmates and others around the world – the global classroom.
7.	Teacher-centered: teacher is center of attention and provider of information.	Student-centered: teacher is facilitator/coach.
8.	Little to no student freedom.	Great deal of student freedom
9.	"Discipline problems" – educators do not trust students and vice versa. No student motivation.	No "discipline problems" – students and teachers have mutually respectful relationship as co-learners, students are highly motivated.
10.	Fragmented curriculum.	Integrated and interdisciplinary curriculum.
11.	Grades averaged.	Grades based on what was learned.

maintain student interest by helping them see how what they are learning prepares them for life in the real world. Second, we must instill curiosity, which is fundamental to lifelong learning. Third, we must be flexible in how we teach. Fourth, we must excite learners to become even more resourceful so that they will continue to learn outside the formal school day.

Comparison of 20th and 21st Century Classrooms

There is an urgent need for all Professors teaching the postgraduate programs in developing countries to adopt the characteristics of the 21st Century classrooms outlined in the above table. This will greatly improve the ability of our graduate students to engage in quality research accordingly.

What is the 21st Century Curriculum?

Twenty first century curriculum has certain *critical attributes*. It is *interdisciplinary, project-based* and *research-driven.* It is connected to the community – local, state,

Table 2.

12.	Low expectations.	High expectations – "if it is not good it is not done". We expect, and ensure, that all students succeed in learning at high levels. Some may go higher – we get out of their way to let them do that.
13.	Teacher is judge. No one else sees student work.	Self, peer and other assessment. Public audience, authentic assessments.
14.	Curriculum/school is irrelevant and meaningless to the students.	Curriculum is connected to students' interest, experiences, talents and the real world.
15.	Print is the primary vehicle of learning and assessment.	Performance, projects and multiple forms of media are used for learning and assessment.
16.	Diversity in students is ignored.	Curriculum and instruction address student diversity.
17.	Literacy is the 3Rs reading, writing and Arithmetic (Math).	Multiple literacies of the 21st Century – aligned to living and working in a globalized new millennium, (7-R's-Reading, Writing, Arithmetic, Rights, Responsibilities, Research, and Recreation).
18.	Factory model based upon the needs of employers for the industrial age of the 19th Century Scientific Management.	Global model, based upon the needs of a globalized, high-tech society.

Source:

national and global. Sometimes students are collaborating with people around the world in various projects. The curriculum incorporates *higher order thinking skills, multiple intelligences, technology and multimedia*, the multiple literacies of the 21st Century, and authentic assessments. Service learning is an important component. The classroom is expected to include the greater community. Students are self-directed and work both independently and interdependently. The curriculum and instruction are designed to challenge all students, and provides for differentiation.

The curriculum is not textbook-driven or fragmented, but is *thematic, project-based* and *integrated*. Skills and content are not taught as an end in themselves, but students learn through their research and application in their projects. Textbooks, if they have them, are just one of the many resources. Knowledge is not memorization of facts and figures, but is constructed through research and application, and connected to previous knowledge, personal experience, interest, talents and passions. The skills and content become relevant and needed as students require this information to complete their projects. The content and basic skills are applied within the context of the curriculum, and are not ends in themselves.

Assessment moves from regurgitation of memorized facts and disconnected processes to demonstration of understanding through application in a variety of contexts. Real-world audiences are an important part of the assessment process, as is self-assessment.

Hence there is need for Professors training the postgraduate students in developing countries to reform training curriculum to match the attributes of the 21st century curriculum, if the graduates are to remain relevant in this 21st century and able to engage in productive original research.

Improve Teaching And Learning By Adopting Constructivism Teaching Approaches In Postgraduate Classrooms/Lessons

The professors teaching postgraduate students need to change their teaching approaches from lecture centered to learner- or activity-centered. They should structure their lessons in forms that postgraduate students are able to read before the lesson and come in the lesson to discuss and make presentation to their colleagues instead of the professors coming in the class and lecture to postgraduate students. Lessons should be conducted in seminar manner. This approach is where each postgraduate student engages in analytical reading, analytical writing and presentation skills in every lesson. This will go a long way to help postgraduate students to engage in research from the taught courses instead of waiting for time to do this when they are already writing their proposals.

In addition, the professors should utilize some of the constructivism teaching approaches to help students develop research skills accordingly. These include the following:

- **Cooperative Learning**

Peer interaction in small group work has become an important area of research in education and the opportunities for dialogue found in these cooperative learning situations are thought to provide a meaningful context for students to connect their new experiences to prior knowledge. Studies of cooperative learning in science have indicated that: “Group dialogue permits students to present their notions about the world and have them challenged. The challenges can lead to cognitive development as individuals realign their thinking as a result of having participated in the dialogue. Cooperative group work also serves to build peer relationships that foster learning” (Coble & Koballa, 1996, p. 466).

- **Problem-Based Learning (PBL)**

Problem based learning is a constructivist approach, which combines problem solving and group work. It emphasizes the use of real-life problems or scenarios as a stimulus for learning. The students are divided into groups of up to ten and meet (say) twice a week under the guidance of a tutor (Berkel & Schmidt, 2000). The process of PBL firstly involves presenting the students with a scenario, case, or vignette, which relates to real life, as a departure point for the learning process. The students then brainstorm themes and questions – this process is designed to allow them to clarify their preconceptions about the topic and to identify their learning needs (Dahlgren & Oberg, 2001). The advantages of this type of learning are that it is authentic (in that the problems are taken from real practice) and it involves cooperative learning. Studies have shown that PBL can be motivating for students and can develop their problem-solving abilities (Berkel & Schmidt, 2000).

- **Hands-on Inquiry**

The shift towards a constructivist theory of learning has placed added emphasis on inquiry as a learning activity. Inquiry involves making observations; posing questions; obtaining information from books and other sources to establish what is known; planning investigations; using tools to gather, analyze and interpret data, proposing answers, explanations and predictions, and communicate the results (Keys & Kennedy, 1999).

Twyford and Burden (2000) have, in a UK study, shown how design and technology, with its creative components, can have the power to effectively engage students in learning. They argued that hands-on creation or experiment is a powerful tool that technology teachers can employ in the classroom even at primary level. The emphasis in Australia on engagement of students in hands-on tasks reflects this approach (Ginns, McRobbie, & Stein, 1999).

- **Integration**

Integration involves making links between different learning areas by studying the ways that each is relevant to a particular issue or theme. Burlbaw et al. (2001) saw compartmentalization of knowledge as a concern in the sciences, where it has also been noted that narrowing or specialization of knowledge may be accelerating as scientific knowledge continues to grow at a rapid rate. However, by integrating between learning areas, it is impossible for learners to make important connections

across disciplines. This involves a recognition that natural connections exist across subject matter areas, and that students' real-life experiences do not reflect the sort of artificial barriers created by different subject areas.

FUTURE RESEARCH DIRECTIONS

Basing on the above suggested strategies, there is an urgent need to conduct empirical research among the postgraduate students to establish the challenges they face in their programs. Also, we need to conduct qualitative studies by getting the stories of those students who fail to complete their research in record time, those who plagiarize, and those who succeed in their research. The author believes these types of studies will inform the key stakeholders how to improve postgraduate curricula to help postgraduate students engage in productive research.

CONCLUSION

All in all, there is an urgent need to address the postgraduate curriculum gap by improving the inputs, processes and output of the curricula in developing countries. This can be attained by adopting the 21st century curriculum and constructivism teaching-learning approaches in postgraduate classrooms.

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KEY TERMS AND DEFINITIONS

Curriculum: A software of any education system that influence the inputs, process and outcome of the training program.

Curriculum Gap: A gap between the intended and implemented curriculum.

Low Resource Settings: A study environment with limited teaching-learning resources like necessary literature, internet facilities, and adequate qualified academic staff.

Post-Graduate Student: A student undertaking studies after obtaining a Bachelor degree.

Research: A process of arriving at effective solution to problems through systematic collection, analysis and interpretation of data.

Research Engagement: The ability to identify the research problem, design the appropriate study design, collect data, analyze data, write the report and publish the findings in referred journals/conferences.