The Epistemological Dilemma: Student Teachers Shared Experiences of Jamaica's National Standards Curriculum (NSC)

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Received: August 4, 2020 Accepted: September 6, 2020 Online Published: November 12, 2020

doi:10.5430/jct.v9n4p29 URL: https://doi.org/10.5430/jct.v9n4p29

Abstract

In this paper, we examined the epistemological dilemma embedded in Jamaica's new National Standards Curriculum (NSC), as seen through student teachers' experience. A basic qualitative research design was used with a purposive sample of ten student teachers, eight females and two males. They were all in the final semester of their four-year teacher education program for a Bachelor of Education in Technical Vocational Education and Training (TVET). Findings indicated student teachers perceived the 5 E-Design process in the new National Standards Curriculum allows knowledge to be constructed through facilitation, conducting research in class, problem-solving, exploration, questioning, real-life experiences, and using active learning strategies. They also reported that resources were lacking in classrooms, some cooperating teachers were resistant to the 5E Methodology, readiness of students were lacking but over time students adopted to strategies used in the 5E approach and began to participate actively in class.

Keywords: STEM integration, new curriculum implementation, student teachers, epistemological dilemma, TVET

1. Introduction

Jamaica, an island in the Caribbean, is categorize as a developing nation. Although gaining independence from British colonialism in 1962, the country still struggles with the impact of its colonial past. Such impact is seen in an education system in which the colonizer aimed to create schools to fit people into their world, creating an estrangement from their culture and heritage, and reinforcing European traditions (Altbach & Kelly, 1992). In light of how the country has evolved from colonialism, the ideology of power and oppression is the primary factor driving an education system fashioned after the British model. This concept is illuminated in the epistemological construct of what it means to know, and historically**,** it frames the philosophical tenets of curriculum design in postcolonial Jamaica.

Presently, there is a paradigm shift in the education system. The education system is now moving to create epistemological diversity through the dispersing of the power of knowing from one to all. Epistemological diversity removes particular assumptions of knowledge construction from the interest of dominant groups or historical traditions. The paradigm shift is evident in the country's new National Standards Curriculum which started to be implemented in 2016. It aims to transform teaching and learning from the traditional subject-centered curriculum designs to project-based/problem-based model which integrates Science, Technology, Engineering, and Mathematics (STEM) in the teaching and learning process. The shift, however, presents an epistemological dilemma, as teachers and students work in unfamiliar pedagogical territory to justify what it means to know.

The National Standards Curriculum is explicitly designed for inclusive learning. Hockings (2010) provides a broad definition of inclusive learning, describing it as ways pedagogy, curricula, and assessment are designed to engage students in learning that is meaningful, relevant, and accessible to all. His definition makes room for considering how broader institutional factors relate to and impinge upon the educational encounter (Lawrie, et al., 2017). The focus of inclusive education is the transformation of educational systems, cultures, and practices, and the reorganization of schools to meet the diverse educational needs of students, so learning and full participation of each child can be achieved (González-Gil et al., 2013). Inclusive learning, therefore, require that teachers understand: 1)

new approaches to knowledge construction, 2) the context and culture involve in learning, 3) the nature of the student and school, 4) teacher's philosophical orientations, 5) the relevance of the change, and 6) assessment and usability/practicality of the curriculum.

An epistemological dilemma can impact the implementation of the curriculum. Therefore, examining the nature of knowledge and how knowledge is constructed in the curriculum is necessary. In this paper, we examine the epistemological dilemma embedded in Jamaica's new National Standards Curriculum (NSC). The epistemological dilemma was examined through the experiences of student teachers completing their teaching internship. Student teachers are individuals who are engaged in the preparation process for professional education licensure or certification. Their collective narratives beg the question, is the theorizing of the new curriculum just a popular initiative or does engagement in the actual practice present a dilemma? Besides, whose knowledge is being represented.

The following research questions guided this qualitative inquiry.

1. What are student teachers' understanding of the National Standard Curriculum 5 E-Methodology?
2. What are student teachers' perception of student engagement with the National Standard Curriculum 5 E STEM methodology?
3. What are student teachers' experiences using the National Standard Curriculum 5 E- Design process?
4. What does teaching and learning look like in the National Standards Curriculum?

2. Literature Review

The changes in the Jamaican education system are explicated in four major policy documents:

- The White Paper, Education: The Way Upward – A Path for Jamaica's Education at the Start of the New Millennium, 2001.
- The Task Force on Education Reform, 2004 Jamaica Report and the resultant Education Transformation Programme.
- The National Education Strategic Plan (NESP) 2011-2020.
- Vision 2030 Jamaica National Development Plan.

According to the Jamaica Education for All Review (EFA) report (Ministry of Education, 2014), significant changes have been taking place in the education system since the year 2000. These changes were made to improve the efficiency and effectiveness of the education system as it prepares its citizens to meet the challenges of the 21st Century. The Ministry of Education and Culture (2001) white paper on education outlined a policy framework addressing the sector's challenges. It sought to address diversity in schools in order to align education to changes occurring globally. The emphasis would now focus on quality education for all and life-long learning. The Task Force on Education Reform (Davis, 2004) developed and articulated the following National Shared Vision through a consultative process:

> Each learner will maximize his/her potential in an enriching, learner-centered education environment with maximum use of learning technologies supported by committed, qualified, competent, capable, and professional educators and staff.
>
> The education system will be equitable and accessible with full attendance to Grade 11. Accountability, transparency, and performance are the hallmarks of a system that is excellent, self-sustaining, resourceful, and welcomes full stakeholder participation. The system will produce full literacy and numeracy; a globally competitive, quality workforce; and a disciplined, culturally aware, and ethical Jamaican citizenry.

According to the EFA report (Ministry of Education, 2014), in order to fulfill this vision, the following recommendations were addressed: construction of new schools and the upgrading of all existing schools to world-class standards and the elimination of the shift system; upgrading of curriculum teaching and learning support systems with particular focus on literacy and numeracy; exposing school boards and principals to new concepts of governance with an emphasis on leadership and administration; building community participation and ownership of schools to influence positive behavioral changes and stimulate a higher level of involvement; and modernization of the Ministry of Education to become a Policy Ministry.

The National Development Plan, Vision 2030 Jamaica (Planning Institute of Jamaica, 2009), stipulated four strategic objectives. The first objective, which *states Jamaicans are empowered to achieve their fullest potential*, speaks to personal and national development through education and training. The following strategies will be employed to achieve this goal:

- Ensure that every child has access to early childhood development.
- Improve the learning environment at the primary and secondary levels.
- Ensure that graduates from the secondary level are ready to go on to higher education, training, or work.
- Promote and use standards to measure the performance of the education system based on results.
- Ensure that adequate high-quality tertiary education is available.
- Ensure access to education and training opportunities for disadvantaged groups, including unattached youths and persons with disabilities.
- Develop partnerships with the private sector, parents, and communities to create quality schools.

The National Education Strategic Plan (NESP) 2011-2020, outlines the macro strategic objectives for the sector (Ministry of Education, 2012). These objectives include: providing equitable access and/or attachment to a high-quality education system for all Jamaican children ages 3-18; improving the standards and quality of Jamaica's education system by establishing a robust accountability framework for all stakeholders by 2015; improving learners' performance across the formal education system and the wider society to achieve universal literacy and at least 85% numeracy by 2015; providing a safe and secure physical environment which is conducive to learning for all learners in public education institutions by 2020; building partnerships with donors, private sector partners, the community, parents, employers, and those committed to creating a strong education system; providing a resource-rich environment supportive of all learners at all levels in the public education institutions by 2020; enabling all learners in the education system to manage challenges and achieve their developmental goals through integrated curriculum offerings and support services to become well-adjusted, healthy and secure individuals; attracting and retaining well-qualified, certified and licensed teachers to fill the requirements of all educational institutions at all levels of the system by 2020.

According to the EFA report (Ministry of Education, 2014), the major challenges impacting the education system are economic difficulties, which affect adequate provision of space, support, and materials. The education system in Jamaica also suffers from a lack of adequate systemwide supervision, resulting in inconsistent quality of educational delivery from rural to urban schools. This is closely connected to the allocation of resources, both material and human, with rural schools and those in volatile inner cities receiving fewer classroom resources and fewer teachers. There is also the need for legislated changes in order to improve accountability and deployment in schools. Unemployment, particularly among the young, is high with over 65 percent having no formal education.

2.1 The National Standards Curriculum

The Jamaican National Standards Curriculum emerged from the recommendations of the 2004 Education Task Force Report (Davies, 2004). The Task Force's objective was to analyze the 1999 revised Primary School Curriculum and Reform of Secondary School Curriculum grades 7-9. The results indicated a lack of developmentally appropriate outcomes that define what children can do and the absence of standards for subject areas other than Mathematics, Science, and Language Arts. The curriculum was too content-heavy, resulting in the inability of teachers completing it in the allotted time frame. It was heavily focused on the retention of factual knowledge rather than on the development of transferrable skills and competencies. It also did not necessarily provide a smooth progression of learning from grades 1-9.

Based on the results, the decision was made to implement a National Standards Curriculum. The rationale for such a curriculum was to allow for greater accountability through the articulation of content across grades from 1-9 and emphasize teaching and learning representative of international standards and global trends. Thus, the curriculum was framed around building 21st century skills to meet the rapid demand for technological growth and social change. The vision for the National Standards Curriculum is to promote a dynamic, challenging, inspiring, and inclusive curriculum to prepare all learners for the 21st century— whatever their needs, background, or ambition. The three key aims which underpinned its direction included: developing successful lifelong learners; developing confident and productive citizens; and building Jamaican identity and citizenship. This required a paradigm shift from the traditional teacher-centered approach to the constructivist learner-centered approach to teaching and learning. The

competencies to be gained are the 4 C's— critical thinking, creativity, collaboration, and communication. The curriculum promotes the 5E model, project-based/problem-based learning, & STEM /STEAM integration.

2.2 STEM Integration

The Ministry of Education Youth and Information, Jamaica (MOEYI), is targeting the improvement of mathematics and science in the curriculum. This move by the Ministry is driven by the need to build a new scientific workforce equipped with modern technological, interdisciplinary skill set (Toulmin & Groome, 2007; Asunda, 2014; Dixon & Hutton, 2016). The argument purported is that for students to be prepared for future career options, they must become critical thinkers, problem-solvers, confident, responsible, and productive citizens. Integrating STEM principles in the curriculum is the proposed framework for connecting today's classroom to the knowledge-driven society and work. STEM concepts are integrated into the module *Resource and Technology* from the primary level to the secondary level of the school system. It utilizes a project-based and problem-based inquiry process model framed on the 5E–lesson planning process which has five phases:

1. **Engagement** – Activity which poses a problem to students
2. **Explore** – Activity for students to research/explore the problem
3. **Explain** – Activity for students to explain their research findings
4. **Elaborate** – Activity for students to apply learning to new situation(s)
5. **Evaluate** – Activity for students to determine if they have solved the problem

STEM integration into the curriculum is an "interdisciplinary teaching approach, where the barriers between the four disciplines are removed" (Wang, Moore, Roehrig, & Park, 2011, p. 2). Huntley (1999), in support of this definition said it is an interdisciplinary approach to teaching, which implies that "the teacher makes connections between the disciplines through the "explicit assimilation of concepts from more than one discipline" (p. 58). Wang and associates believe STEM integration can be achieved by adding a design project as the culminating activity to a unit. Dugger (2010), however, argued that there are several ways to integrate STEM into the curriculum. They include: (1) teaching each of the four STEM disciplines individually, (2) teaching each of the four STEM disciplines with more emphasis going to one or two of the four (which is what is happening in most U.S schools today), (3) integrating one of the STEM disciplines into the other three, or (4) infusing all four disciplines into each other and teach them as an integrated subject matter.

2.3 Project-based, Problem-base, and Inquiry-based Learning

Scheurich and Huggins (2009) noted that mathematics and science courses are usually taught abstractly. They believe, however, that project-based learning can reverse this notion and engage students in real-world projects through which they learn math and science formulas and laws upon which the world is now increasingly built (see also Havice 2009; Laboy-Rush, 2011). Savery (2006) notes that "project-based learning is similar to problem-based learning in that the learning activities are organized around achieving a shared goal ([such as the] project)" (p. 16). He notes that this approach is a valid instructional strategy that promotes active learning and engages learners in higher-order thinking, such as analysis and synthesis. A well-constructed case will help learners understand the essential elements of the problem/situation so they can transfer to similar situations in the future.

Savery (2006) went on to make the distinction between inquiry-based learning and problem-based learning (PBL). He stated that "the primary difference between PBL and inquiry-based learning relates to the role of the … [instructor]. In an inquiry-based approach the [instructor] is both a facilitator of learning … and a provider of information. In an PBL approach, the [instructor] supports the process and expects learners to make their thinking clear, but the … [instructor] does not provide information related to the problem—that is the responsibility of the learners" (p. 16).

Dixon and Hutton (2016) spoke about the importance of integrating STEM through project-based learning and PBL activities at the secondary level in Jamaica. For example, addressing grades 7-9, they said, there must be culminating experiences, whether through problem-based or project-based activities, which require students to collaborate in the solving of authentic problems related to the occupational areas, and which require the application of STEM concepts.

2.4 Teacher Development

The new curriculum requirement has implications for how teachers are prepared to deliver content in the classroom. Teachers must be prepared with the competencies to facilitate engagement that involves problem-based, project-based, and inquiry-based learning. As indicated by Dixon and Hutton (2016), teachers will need to

collaborate across content areas to design, deliver, and facilitate learning experiences that lead to STEM learning outcomes. The EFA report stated that for Jamaican teachers to be able to teach 21st Century students, they should be equipped with requisite skills categorized as *Ways of thinking*, *Ways of working*, *Tools for working*, and *Skills for living in the world*. Ways of thinking entail creativity, critical thinking, problem-solving, decision-making, and learning. Ways of working involve communication and collaboration skills. Tools for working include information and communication technology (ICT). Skills for living in the world entails understanding one's role regarding citizenship, life, career, personal, and social responsibilities (Ministry of Education, 2014, p. 23).

3. Theoretical Framework

Cesaire described colonization as being equal to "thingification,". This is where the colonizing man is depicted as a classroom monitor, an army sergeant, a prison guard, a slave driver, (superior), and the indigenous man (colonized) is an instrument of production. He stated "I am talking about societies drained of their essence, cultures trampled underfoot, institutions undermined, lands confiscated, religions smashed, magnificent artistic creations destroyed, extraordinary possibilities wiped out (Cesaire, 1972, p. 21).

Postcolonial theory is a site of dialogic encounter that pushes people to examine conditions under which they live. Thus, it can be applied to define all kinds of struggles, psychological conditions, texts, practices, or concrete historical processes (Dimitriadis & McCarthy, 2004). Postcolonial theorist Said's (1979) notion of Orientalism (*Othering*) provides an interesting perspective on how colonialism impacted culture, and by extension, ways of thinking.

Said (1979), contextualized the concept of *Otherness/Orientalism* to provide an ontological perspective of the way people live in the Orient. He argued that Orientals are viewed as having no history or culture, independent of their colonial masters. Further, he maintained that in light of this unawareness, the West carved out a framework for them in terms of their culture, history, and future. Therefore, to understand the concept of *Otherness/Orientalism*, one must understand the power relationships that exist within.

Orientalism is evident in the colonial education framed by the British. Teachers were trained to possess the wealth of knowledge, and students were the receptacles. Hence, the power relationship between the teacher and student sparks great similarities to the power relationship of Orientalism. Teachers were concerned with the training of the mind and not fostering the growth of the mind.

Postcolonial theory intervenes in the contradiction between binary opposites within the discourses of society, a product of historical and cultural inequity. The colonial-era fostered the ideology of the oppressor and the oppressed and postcolonial theory interrupts these hegemonic constructs embedded in postcolonial societies. From a postcolonial perspective, the complexities of the new National Standards Curriculum (NSC) can be examined to determine what frames the philosophy of the teacher, the impact colonial culture has on education, and the teacher's acceptance of the National Standards Curriculum design (Dimitriadis & McCarthy, 2004)

4. Method

A basic qualitative research design was used. According to Merriam (2009), a basic qualitative research study is derived philosophically from constructionism, phenomenology, and symbolic interaction. It is used by researchers to explore how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences. Therefore, it can be used to explore processes in education, uncover strategies, techniques, and practices of highly effective teachers and administrators.

4.1 Sample

A purposive sample of ten student teachers, eight females and two males, participated in the study. These teacher candidates were selected from their Instructional Practice class. They all were in the final semester of their four-year teacher education program, which required them to complete internship in secondary high schools in rural or urban areas of Jamaica. They were pursuing a Bachelor of Education in Technical Vocational Education and Training (TVET) with a specific focus in Food Service Production and Management. They were trained to teach Resource and Technology (R & T) at grade levels 7-9. R & T is a Technical and Vocational subject concerned with the creative and innovative use of tools, materials, equipment, knowledge, skills, and systems to solve real-life problems. It introduces the use of scientific, technological, engineering, and mathematical (STEM) principles in selecting and manipulating resources to solve problems. This subject is required for all secondary high schools in Jamaica, as its focus is the development of STEM skills through problem-solving and project-based learning.

4.2 Procedure

While completing their internship, student teachers were observed four times over a three -month period. Focus group sessions were conducted midway to allow for reflection. Face-to-face interviews were conducted with each teacher candidate to gain a deeper understanding of their internship experience. Focus group discussion and face-to-face interviews were recorded and transcribed.

Transcripts were coded using the following preassigned categories: understanding of the NSC approach to curriculum; perception of the classroom environment; experiences using the NSC approach; perception of students; how student teachers engage with cooperating teachers; and what teaching and learning look like in the NSC. For trustworthiness, transcripts were member-checked by each participant to ensure they reflected what was said. The content of transcripts was triangulated with comments made by participants in the focus group and notes taken by the university supervisor during observation of student teachers while on internship.

5. Findings

5.1 Research Question 1: What Are Student Teachers' Understanding of the National Standards Curriculum 5 E-Methodology?

Student teachers understood the 5 E Methodology as a process that allows knowledge construction through the following mediums and engagements: facilitation, researching activity in class, problem-solving, exploration, questioning, real-life experiences, and using active learning strategies. Table 1 provides verbatim of student teachers expression of their understanding of the curriculum:

Table 1. Student Teachers Understanding of 5E Methodology

	Student teachers' comment about the NSC 5E Methodology
Theme	Supporting Comments
Teacher as facilitator	*Knowledge is constructed by teacher providing students with resources. Resources assist with the development of the content during the class. The teacher act as a facilitator, which means that it is not teacher centered, where teacher would have complete control over the lesson and the knowledge. Additionally, the teacher will pull from the students by asking a series of interrogative questions about the topic or subtopic and students are allowed to share their own experiences*. (Student teacher 1)
	Knowledge is constructed based on the student's ability to explore for themselves while the teacher guides or facilitate their learning. In the STEM classroom, teachers no longer dictate to students, rather, they facilitate students learning. (Student teacher 2)
Real Life Experiences	*In the classroom, knowledge is constructed based on real life experiences and resources that teacher brings into the classroom to facilitate learning. The teacher uses real life situations which most students are able to relate to and ask them critical questions relating to the topic. These critical questions usually lead to students answering in the best possible way they know how*. (Student teacher 3)
Probing/Questioning	*From my understanding of a 5 E STEM class, knowledge is constructed through probing and pulling information from the students then introduce new information through activities, which reflects how much the students grasp the concept.* (Student teacher 4)
Active Participation	*In the 5 E STEM classroom participation in the classroom help students build a strong foundation of knowledge through active participation by choosing different activities. When choosing these activities for the different 5 E Design phase, teachers utilize these strategies so that it can help students to gain a complete understanding of new concepts. The 5E STEM lesson class aim for students to engage, explore, explain, enrich and elaborate these phases motivate them to learn and guide them towards skill development.* (Student teacher 5)

5.2 Research Question 2: What Are Student Teachers' Perception of Learning in the National Standards Curriculum 5 E Design Process?

Student teachers recognized the advantage of having a STEM classroom that uses the 5E Design process approach. They articulated that with the proper resources in place, that type of environment is more conducive to learning.

> *Compared to the traditional class where the responsibility is strictly on the teacher, I think that students are learning. They play a major role in the classroom. For example, when I am teaching my grade nine students, I engage them in a series of activities where they are using resources to support the content and also learn during the process.* **(Student teacher 1)**
>
> *In the 5 E design STEM classroom students are learning in this environment. The reason for this is learning should be fun, students get to see real life objects and also students get the opportunity to research on their own, work as a group, share ideas and ask questions as it relate to the topic. The lesson is centered around a big idea and a problem in which they should solve. Students are more engaged because of the fun activities that can be used to carry out a lesson and because of this student have more interest in learning.* **(Student teacher 6)**
>
> *I believe that students do learn in this kind of environment if the school has the proper resources available. When the resources are available there can be no limits to a STEM classroom. In my classroom I try to carry as much resources for the lesson as I can so that students can engage in a variety of class activities.* **(Student teacher 7)**

The comments of student teachers during the focus group acknowledged that there were some tension or challenge in using the 5E approach, as students were accustomed to the teacher-centered approach used by teachers. Strategies such as culturally responsive approach had to be used to engage students in constructing knowledge.

> *I realize a few teachers were able to involve their students in the lesson but some refuse to conform to this new approach. In some cases, students cannot learn in the STEM classroom because they were not taught to think on their own. Therefore, they become lost in the classroom environment.* **(Student teacher 3)**
>
> *The students were accustomed to being sponges and soak up every information that their teacher presented them. However, I was a constructivist in my classroom. I encouraged independent thinking and allowed students to reinforce their ideas. I challenged students to reach beyond the simple factual response.* **(Student teacher 2)**
>
> *In a Jamaican classroom, I think it is important to relate information in a way that students can culturally understand. I acknowledged this and framed my activities around this. For example, when I used the game taboo in class, I gave the clues but students were not responding. I eventually handed the game over to a student and she used clues which students could relate to. The clues she used related to what students knew culturally and were exposed to in their everyday life. I then related the lesson to what they understood*. **(Student teacher 7)**
>
> *Content given to students should be given in an easy and fun way so that students can relate and retain information given to them. Students have a hard time retaining information but if it is given in a fun way that they can enjoy it and they will remember. As the teacher of the class on teaching practice I ask students questions that will guide them…* **(Student teacher 6)**
>
> *While on teaching practice I noticed that students do not play a role in the lesson. Students are seen as empty shells waiting to be filled by the teacher. They are not allowed to share their information, they are not allowed to do research outside the classroom and then share with their teacher and peers*. **(Student teacher 1)**

5.3 Research Question 3: What Are Student Teachers' Experiences Using the National Standards Curriculum 5E Design Methodology?

While student teachers had mix experiences in terms of the level of support they received from cooperating teachers in regards to resources, most agreed that the cooperating teachers were not very knowledgeable of the 5E STEM curriculum.

> *My experience using the STEM lesson plan was a little challenging because of three factors; the first factor was the students. The method was new for them so it took some time to introduce it. They are used to their teachers giving them a textbook and telling them to write from pages 199-209. I brought something different, fun and engaging. I allowed them to be a part of the lesson. The second factor is the availability of*

> *resources. It was hard for me to provide all the resources that were needed for the students to effectively learn in this curriculum…The third factor was the cooperating teacher was not familiar with this curriculum, so she was not encouraging.* **(Student teacher 1)**
>
> *There were moments I felt like giving up because the cooperating teacher was giving me some challenges. The cooperating teacher did not like the STEM methodology at all and often expressed his hatred towards this method of teaching.….I felt as though I wasn't the teacher of the class at all. I had to teach most of my lessons the way he (cooperating teacher) wanted and not how I was taught to do.* **(Student teacher 6)**
>
> *When using the STEM 5 E Design curriculum, I ran into a few challenges while planning the lesson. The cooperating teacher were of no help. They did not provide resources such as books and no help on managing the student-centered classroom. The students were all over the place.... Over time however, I got them into thinking for themselves and not relying on the teacher to bring content to the class each week. I helped them to use creative ways to learn from each other. I barely ever saw the cooperative teacher.* **(Student teacher 9)**

Some student teachers, however, received good support from the school cooperating teachers.

> *My experience using the 5E design curriculum was a good experience. The students liked working on projects because they get a chance to learn more. The students did not like group work in the beginning, but they became accustomed eventually. Also, the students enjoyed the learning activities especially the exploration phase. They loved the use of technology and also doing research*. **(Student teacher 2)**
>
> *I was grouped with a supportive team at my school. The teachers there provided great support system for me. As it relates to the STEM methodology however, I have more experience than them so they would advise me of the objectives they want to be covered and I plan the STEM lesson and send to the grade teacher…In teaching using the STEM lesson plan I realized no matter how simple the activity, students' retention was so short. Constant repetition was needed for them to complete a simple task.* **(Student teacher 7)**

5.4 Research Question 4: What Does Teaching and Learning Look Like in the National Standards Curriculum?

Overtime some student teachers recognized that students adopted to the strategies used in the 5E approach and began to actively participate.

> *In the beginning, students were unresponsive throughout the class session. I asked critical questions, and they were not responsive. I eventually had to "dumb down" the questions for them to understand. As the weeks progressed however, I was able to ask critical questions and they were able to answer them without as much facilitation from me.* **(Student teacher 3)**
>
> *I find that most students appreciated the approach. They were so involved in their learning. They liked using the STEM activities and they respond very well to the incentive chart. In every class there were students who were very eager to learn and participate.* **(Student teacher 7)**
>
> *I observed that my students were in favor of the new approach only when I brought different resources for them to use. If I don't bring any resource they are not interested to complete tasks.* **(Student teacher 5)**

Comments from individual interviews and focus groups revealed that the cooperating teachers did not apply the strategies in the STEM curriculum in their class, and most continued to use the teacher-centered approaches typical of the old paradigm.

> *My cooperating teachers told me that I should not use the new curriculum to teach her students. She said because it is a lot of work and she was not trained to use it.* **(Student teacher 1)**
>
> *My assessor however was more interested in seeing me use the new methodology. My supervising teacher at the school showed little to no interest in the lessons being taught. His facial expressions showed signs of antipathy. He didn't care that the students were getting hands on experience and solving real life situations. He just wanted the students to receive information.* **(Student teacher 6)**
>
> *The teachers barely know what they are doing. They choose to stick to the traditional way of teaching which is to flood the students with notes every class session.* **(Student teacher 3)**
>
> *My supervising teacher at the school did not want to view my lesson plans. She said they are written too long and they have no papers to print all of that...* **(Student teacher 10)**

6. Discussion and Conclusion

The new NSC in Jamaica represents a progressive path on which the education system now embarks. Its conceptualization is indeed needed to transform the teaching and learning environment. However, this transformation is constrained by the curriculum's deficiency at meeting the demands of the technological age. The technological age demands classrooms to be equipped with the tools, resources, skills, and competencies necessary for learning in the 21st century.

It was clear student teachers understood the purpose of the curriculum. The major epistemological dilemma, however, is rooted in the ***practice*** of the curriculum, which is dependent on the relationship between the student teacher (novice) and the cooperating teacher (expert). The school should play a central role in shaping the environment for the implementation of the practice of the curriculum. If cooperating teachers are not knowledgeable or interested in the implemented curriculum, then student teachers' practice will be impacted. The enactment approach to curriculum is a joint process (Snyder, Bolin, & Zumwalt, 1992), as curriculum "knowledge is no longer a product as in the fidelity and adaptation approaches, but ongoing constructions out of 'the enacted experiences… [that] students and teacher create" (p.410). Change is neither about implementing nor even adapting curriculum, but "a process of growth for teachers and students, a change in thinking and practice" (p.429). The teacher's role, therefore, ranges from using, adapting, and supplementing external curriculum to curriculum-making (Clandinin & Connelly, 1996; Craig, 2006).

Student teachers observed that some in-service teachers were not trained to use the new curriculum. This presents a deeper epistemological dilemma, the retooling of teachers, which the education ministry and schools must play a more significant role in doing. What then is the school's purpose in curriculum implementation and innovation, particularly as it relates to new teachers and in-service teachers? The school is the training ground for student teachers, and as such, the environment should model the practice. In understanding the characteristics of change, Fullan (2005) discussed the importance of understanding the need and relevance for change, clarifying its goals to the various stakeholders, explaining its complexities, and ensuring implementers are aware of its quality and practicality. If teachers in the schools are not trained, then they will not understand the curriculum change. Smith, O Day, and Cohen (1990) provided a cautionary measure for implementing a new national curriculum. They opined a worthwhile effective national curriculum requires the creation of many new social and intellectual connective tissues. For instance, the teacher education's content, pedagogy and assessment would have to be closely related to the content and pedagogy of the schools' curriculum. Presently, such connections do not exist and in-service teachers are still teaching to the old curriculum. They further concluded that such a new curriculum will not be easy, quick, or cheap, especially if it is to preserve variety and initiative. Consideration, therefore, must be given to the following elements; students, teachers, subject matter, the social learning environment and the curriculum specialist (Lawrie et al., 2017).

6.1 Resistance to Change

We cannot ignore the epistemological dilemma that is present in the education system as the country makes the paradigm shift to include the 5E STEM curriculum. The curriculum's dilemma is rooted in philosophical beliefs concerning whom the curriculum represents, the practice/delivery of the curriculum, skepticism/criticism, and methodological issues. Staff development is one strategy involved in the larger framework for curriculum implementation. We must, therefore, undertake a re-education of skills and competencies, which include sharing sessions with colleagues, generating teaching ideas for new curriculum units, and consultations. Another component is resocialization to change certain skills, attitudes, and habits. Teachers must recognize their role and the behavioral alternatives available to them, and determine which ones are applicable under a given situation (Fullan, 2005). There is no single solution to change and crafting one's theories and actions by being a critical consumer is important (Fullan 1999). Major factors affecting implementation of the NSC in Jamaica include local characteristics, and external factors (government and other agencies). Most of the resistance to change seem to stem from the school level (local level).

6.2 The Education Context

According to Apple (1993), in complex societies driven with differential power, the only kind of cohesion possible is one in which we overtly recognize differences and inequalities. The differences in the Jamaican classroom can be very pronounced. The curriculum, therefore, should not be presented as objective. Instead, it must continuously subjectify itself. It must acknowledge its roots in the culture, history, and social interests out of which it arose.

Jamaica's education system is framed on inequity, and resources are scarce in the inner-city, rural, and non-elite schools. Can a 5 E STEM curriculum be enacted the way it was intended for all? How does a National Curriculum decrease the divide or disparity among schools? Who benefits?

We have argued that the epistemological dilemma in Jamaica's National Standards Curriculum impacts its implementation. Curriculum planners should not ignore the contextual struggles which impact knowledge generation. The curriculum is not just theory but also practice. In the practice of the curriculum an epistemological dilemma is created in the following ways; enactment of the curriculum, disconnect between teacher preparation and in school practice, lack of resources to support content knowledge, students' educational experiences, cultural context, and teachers resistance to change. We therefore question if it is possible to sustain a National Standards Curriculum given the dilemma and if these issues are not systematical addressed.

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