

Study Practice Lessons and Peer Learning Methods to Strengthen Rwandan Science and Mathematics Teaching

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Introduction

Since it has been found reasonable by most countries to shift to a competence-based educational structure from the so-called knowledge-based curriculum (Ndihokubwayo & Habiyaremye, 2018), Rwanda is now positioned to build a competence-based economy through science, technology, engineering and mathematics (STEM), as an accelerated tool for advancement. Peer learning (Gwee, 2003) which essentially refers to individual learning with and from each other without any implied authority has played an enormous role in stimulating Rwandan teachers towards understanding the philosophy of Rwanda's education and implementation of the new curriculum here referred to as a competence-based curriculum. In this regard, teachers gathered together to express their own ideas in front of their colleagues in order to understand better without compromising the truth flowing from each other on various issues related to teaching and learning during their daily routine activities. In addition to the subject of knowledge acquisition, according to Gwee (2003), peer learning is usually practiced in small collaborative groups, cherishes and it raises the development of self-directed learning skills, and thus lays the foundation for life-long continuing self-education; critical thinking and problem-solving skills; communication, interpersonal and teamwork skills, as well as learning through self, peer assessment and critical reflection. In order to strengthen pedagogy, peer learning is structured to include several teaching and learning practices such as peer tutoring, peer instruction,

cooperative or collaborative learning as well as group work (Tennessee, 2005). Therefore, its outcomes ultimately depends on the design strategy, outcome objectives of the course, facilitating skills of the facilitator and the commitment of both teachers and facilitator (Gwee, 2003). There are many forms of practices that use peer learning strategies such as continuous professional development, school-based in-service teacher training, and lesson study reserved as the purpose of the present study.

Japanese Lesson Study

During its piloting stage, the Japan International Cooperation Agency (JICA) and the Rwanda Education Board (REB) joint project (SIIQS) (the project for Supporting Institutionalizing and Improving the Quality of School-based In-service teacher training (SBI)) has helped several schools in Rwanda, including APAGIE Musha, GS Saint Aloys Rwamagana, GS Kabuye, Ecole Primaire Buhande, Lycee Notre Dame de la Visitation Rulindo, Lycee Notre Dame des Apotres Rwaza, GS Mukarange to name few. Its 3-year project (2017-2019) has been a pilot project of SBCT¹, which got completed in 2012-2015 (Padeco, 2012). It is also a predecessor project of the SMASSE², which was implemented in 2008-2011 (Tindi, 2010). All of these projects and the current SIIQS project, currently focus on the improvement of teaching and learning of Mathematics and Science both in primary and secondary schools. A lesson study was originated from Japan and it has been among the continuous professional development (CPD) activities in Rwanda. Apart from funded practices, even though these projects were neither compulsory nor funded in Japan, the lesson study was not only adopted in East Asia. South-East Asia and some Western countries have demonstrated their attention towards same (Doig & Groves, 2011). This Japanese lesson has emerged in many countries, such as Japan, Indonesia, Cambodia, Bangladeshi, U.K, USA, Kenya, Zambia, Malawi, and Rwanda etc. As a body of knowledge for Science and Mathematics, this lesson study comprises a four steps in its operational cycle:

- (1) Teachers from the same subject gather together, brainstorm and compromise on a crucial problem in their teaching activity (Problem identification);
- (2) Using textbooks, scheme of work and syllabus, the same group of teachers plans a lesson (Lesson planning);

¹ SBCT: School-based Collaborative Teacher Training

² SMASSE: Strengthening Mathematics and Science in Secondary Education

(3) One teacher teaches the lesson in front of his/her fellow teachers (Microteaching). After teaching they sit together and discuss (Post-lesson study) how good and weak the lesson was, and plan for improvement before implementing into the classroom; and

(4) After reviewing the lesson plan, the same or another teacher takes it to the classroom (Classroom implementation) while other teachers are observing. After the lesson, teachers evaluate the lesson (Post-lesson study), if problems persist, they repeat the process.

A study focussing on teachers' discussion conducted by Nakazato (2013), showed a weakness existed among of Zambian teachers who did not make lesson plans before lesson study. From this regard, a group of teachers planed a lesson collaboratively; from that practice, the teachers could teach and learn how to make a lesson plan themselves. When it ended in 2011, it was reported that more than 70% of target schools had been implementing lesson study and expanded to all provinces in Zambia (Nakazato, 2013). The same study showed the strength of teachers' discussion or post-lesson study. For instance, not only the teacher who delivered the lesson but also this discussion gave the opportunity to other teachers who observed the lesson to speak out their opinions. In a lesson study and throughout its process, "Plan, Do, See, and Improve" (PDSI) cycle may be used to carry it out, and "Activities, Students, Experiments, and Improvisation" (ASEI) may play a key procedure through the lesson delivering and its innovation. This lesson study is not stand alone practice, it is, however, a practice that is accelerated or supported by other frameworks like continuous professional development and school-based in-service teacher training.

Continuous Professional Development (CPD)

Actually, earning a degree from a Teacher Training College is just the beginning of the learning process needed to develop effective teachers. When teachers—even those with the correct formal qualifications—enter the classroom for the first time, there is a great deal that they still need to learn about effective instruction. Though they will gain some of these skills simply through experience, they would hone their knowledge and abilities to a much greater degree through formal continuing professional development opportunities that link the study of theory to systematic

changes in practice (Save the Children, 2011). Teacher professional development is driven by the need to both extend and renew teacher practice, skills and beliefs. Stimuli for such needs may be curriculum change, new classroom technology and advances in pedagogy. However, the underlying endeavour is to improve outcomes for students, whether they are focussed on understandings, skills, attitudes, or engagement (Doig & Groves, 2011). While professional development is displayed as a kind of learning to maintain professional permits such as academic degrees to formal coursework, a continuous professional development includes attending seminars, training, and conferences and involves informal learning opportunities situated in practice. There are a variety of approaches to professional development, including technical assistance, communities of practice, peer mentoring, and lesson study (NPDCI, 2008).

It is not surprising then, that international attention has turned to less familiar, but apparently more successful, professional development practices, such as lesson study. Thus, opportunities to experiment with classroom practice and analyse it in detail—an important feature of Japanese lesson study—is likely to be a fruitful path to take in teacher professional development. There is wide consensus among researchers and practitioners that teachers are the most important factor in the quality of education in schools, and it is, therefore, clear that supporting the professional development of teachers makes a key contribution toward improving educational systems and the learning outcomes of students (Knudsen, Elvira, Soren, Petkova, & Nikolovska, 2013). The professional development of teachers is a lifelong, career-wide process that starts at university and ends at retirement.

According to Knudsen, Elvira, Soren, Petkova and Nikolovska (2013), teachers have an on-going commitment to maintain their professional expertise and they must recognise themselves as learners involved in the continual revision and enhancement of their knowledge and skills, and their teaching and learning strategies. In the study of Dutto (2018), teaching is a profession which adopts advanced standards not as means of control but as foundations of advanced performance, therefore teachers' knowledge and competence are goods for investment that is why they should not be consumers of training courses. Instead, they should be the most updated souls with a well-equipped material able to upgrade their learners through daily practice within fellow such as school-based in-service training.

School-based In-service Teacher Training (SBI)

Through school-based CPD, there are good possibilities for capitalising on the school-based in-service teacher training. Since the division of work between the national authorities and projects in schools seems to function well and it is now important for new schools to join the network. The formal recognition of the school-based modality for in-service teacher training provides a good legal and administrative basis for rolling out the CPD initiative at the national level (Knudsen et al., 2013). SBI training program is the appropriate answer to expand opportunity for teachers to learn, to maintain and to update their knowledge, teaching skill, and attitude. SBCT project aims to encourage teachers to cooperate and share their experience through peer learning activities with planning; monitoring and feedback system (JICA, 2014). The concept of SBI is common and it is already in Rwandan schools. In fact, the baseline survey conducted by SBCT project team confirmed that about 50% of surveyed Rwandan school actively implemented SBI (REB & JICA, 2014). While “off the job training” is organised by the parties such as REB or any NGO, the “on the job training” form of SBI is initiated by teachers and/or schools in order to address problems or issues that they are encountering where it is organized in a local context to solve or improve a specific problem happening at school (REB & JICA, 2014) with various activities related to the daily curriculum such as lesson planning, teaching methods, ICT integration, and so on. This role plays in giving teachers to learn from each other and solve the economic constraints.

According to one teacher from GS Kabuye, SBI changed the atmosphere of their school. Teachers have become very collaborative and freely share good practices without setting formal meetings. However, a major problem associated with the school-based in-service teacher training initiatives is the apparent lack of capacity and infrastructural support structures in most schools to sustain the programmes (Junaid & Maka, 2015). This necessitates close mentoring of trainee teachers by senior and more experienced teachers and inspectors. These problems underscore the need for major investments in this training structure to build the capacity of teachers at all levels of their education systems (Junaid & Maka, 2015). Therefore, this concept should be adopted to cover this kind of challenges.

Lesson study Practice and Outcome

The lesson study has been practiced in several schools in Rwanda from 2017 to 2018 implemented through SBI activities by the SIIQS project and its achievement has been visualised in these schools. For instance, in one school after studying

science and elementary technology (SET) course, Primary four (P4) pupils showed interest in learning “mammals” and “air properties” through a well-designed teaching material (SIIQS Project, 2017). In another school, after teaching Pythagoras Theorem, due to this lesson study practice, almost all tested Senior two (S2) students were able to get full marks at the Post-Test. Teachers also got mutual working practices as well as research for better teaching delivery. For instance, when we asked teachers who practiced the lesson study, they showed positive attitudes towards its practices. For instance, teachers provided the advantages of lesson study such as (a) Lesson study helps to share methodologies and interacts with peer teachers, it overcomes the challenge and difficulties in preparation of lesson plan, it is helpful to such way of motivating the learners; (b) It allows to share the way of teaching, help teachers to know their strengths and weaknesses, and help teachers in improving the ways of motivating learners; (c) Lesson study helps teachers to improve their knowledge in planning and delivering lessons as well as improve the teaching method since it allows teachers to know the new process or method of teaching; (d) The lesson study improves the teaching and learning processes, improvement of preparing lesson materials. Since it is peer to peer learning, therefore, it improves teaching and learning process; (e) “It helped me to use the appropriate stage of a good lesson preparation; therefore it will help me to implement CBC.” “I will improve my lesson study by preparing many lesson plans; share them with other teachers before implementing them in the classroom” (personal communication, 2018).

Conclusion

The literature review showed the relationship with the lesson study with other practices such as CPD, SBI through Peer learning altogether contributing to the implementation of Rwandan CBC. Lesson study practices showed tremendous successes, however, lack of the time for doing the steps of lesson study, lack of the teaching materials to accommodate CBC, big number of learners in a classroom, low level of learners, and English language problem to both teachers and learners were screened out by stakeholder-teachers as the challenges met while performing it. Therefore, in order to improve lesson study practice, the lesson study activities must be decentralised in all schools, teachers should well prepare the lesson to teach, they should be encouraged to work through SBI, and provide much training. Since teachers need enough nonteaching time to participate in CPD opportunities and to put their learning into practice by developing new lesson plans (Save the Children, 2011), therefore, district education and school leaders should participate

(Ndiokubwayo, Habiyaremye, & Rukundo, 2018) and the lesson study should be allocated in school timetable and the students should be sensitised to learn and relate the lesson by real life.

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Biography

Ndihokubwayo Kizito is a PhD student in Physics education at the African Centre of Excellence for Innovative Teaching and Learning Mathematics and Science (ACEITLMS), University of Rwanda College of Education (URCE). He is currently a part time consultant at SIIQS project working as Research assistant and Monitoring officer in Science field.

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Both authors pursued their Master's degrees from the graduate School for International Development and Cooperation (IDEC), Hiroshima University, Japan in 2016, and have participated in the 3rd Phase Competence-based curriculum (CBC) training as facilitators in 2017-2018.