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IMPROVING SECONDARY SCIENCE INSTRUCTION THROUGH CONTENT AND LANGUAGE INTEGRATED LEARNING (CLIL) IN SRI LANKA

Research Article

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Abstract

There has been a growing interest in incorporating CLIL (Content and Language Integrated Learning) methodology in the Sri Lankan national education system. CLIL refers to methods where subjects, or parts of subjects, are taught through a foreign language to improve both academic subject knowledge and foreign language skills. The 4C's model of Coyle et al (2010) is a popular model for the implementation of CLIL and Sri Lankan system has encouraged using this CLIL model. The main objective of this study was to inquire how CLIL is implemented in secondary science classrooms and to support the teachers. The study was action research. The collaborative action research group comprised a faculty member, a postgraduate research student and ten secondary science teachers from five schools. Arising from the fact-finding needs analysis, the intervention designed included researcher-led teacher workshops to support teachers to plan CLIL lessons. The lessons were implemented in the respective schools by the sample of teachers during school two terms with the support of the researchers. The study concluded that curriculum materials were not focused on CLIL and teachers needed heavy support for content and language integrating for the teaching of science in secondary classes. Preparation of teacher instructional manuals addressing CLIL and in-service teacher development for CLIL lesson planning is recommended.

Keywords: CLIL, action research, secondary science, intervention, 4C's model

1. Introduction

Sri Lankan system of education is focused on the global sustainable development objective of "ensuring quality and equal inclusive education approach for all as well as providing opportunities to promote lifelong education" (Ministry of Education, 2015, p.4). Education in mother tongue promoted education excellence in most learners in Sri Lanka. However, the need to attain proficiency in the English Language became a priority. However, learning English as a subject in the secondary school curriculum was not found to be adequate. The bilingual policy was introduced in 2001 in Sri Lanka to offer some of the subjects in GCE Ordinary Level in English medium while other subjects were offered in the mother tongue.

Education Sector Development Framework and Program 2013-2017 (Ministry of Education, 2012) emphasized the establishment of Content and Language Integrated Learning (CLIL) framework as the theoretical framework of bilingual education. The acronym CLIL denotes any dual-focused type of provision in which a second language, a foreign language or another, is used for the teaching and learning of a non-language subject matter, with language and content having a joint and mutually beneficial role. In Sri Lanka the first national language is Sinhala while the second national language is Tamil. English is the second and the link language in the Sri Lankan official system of languages. Hence, there is a need for studies on the classroom realities of CLIL approach used in the bilingual program. This study focused on

the aspects of teaching-learning resource texts and CLIL lesson planning through a developmental perspective.

2. Background

The bilingual stream of the study was scaled-up to the secondary grades in 2002, promoting the learning of and in two languages to support the content and language requirements of the learner. Sinhala and Tamil are the two national languages through mainstream education are imparted. In the initial implementation, bilingual stream of education focused on teaching Science and Mathematics in English medium from grades 6 to 11. National Policy on bilingual education is as follows:

> Bilingualism should be promoted by using English as the medium of instruction for selected subjects such as mathematics, science, technology including computer literacy initially. It is expected that students will reach an acceptable level of proficiency in English without jettisoning Sinhala and Tamil which will continue to be the medium of instruction in selected subjects. (National Education Commission, 2003: 116-117)

A specific feature of CLIL is that teaching the content is not *in*, but *with* and *through* the foreign language (Marsh 2002). Coyle, Hood and Marsh (2010) have forwarded a theoretical model for effective CLIL implementation through a '4Cs model' which is a holistic approach, where Content, Communication, Cognition, and Culture are integrated. Content denotes progression in knowledge, skills and understanding of content; Cognition is the engagement in higher-order cognitive processing; Communication is the development of appropriate communication skills; and Culture is the acquisition of deepening intercultural awareness.

The Department of Science and Technology and the Department of Foreign Languages and Bilingual Education of the National Institute of Education (NIE) was given the responsibility of developing syllabi and training teachers to use CLIL, particularly in teaching science, English and mathematics in 2013. There had been two significant revisions of the secondary science curriculum. The first was in 2007, and the second revision was in 2013. It is of paramount importance to identify and examine how helpful are the curriculum materials to the science teachers in bilingual contexts to integrate the theoretical and practical aspects of CLIL.

With the introduction of bilingual education both teachers and students encountered a set of new challenges. This paper reports a classroom action research effort to investigate the ground situation of bilingual science classes and to make a collaborative intervention to address challenges faced by teachers.

3. Objectives of the study

The objective of this study is to analyze how far CLIL has been incorporated into the secondary science classrooms. The following research questions were adopted.

1. How helpful are the changes integrated into secondary science syllabi and textbooks to support CLIL with the recent revision of materials?
2. How do the bilingual science teachers implement the science curriculum through CLIL?
3. What are the realities of adopting CLIL into secondary science teaching and learning?

4. Review of literature on science teaching and learning through CLIL

Bilingual education and CLIL literature are vast across the world. However, the applicability of literature from one context to the other depends upon many factors as 4Cs vary

in their operationalization in different contexts. However, some studies reviewed here facilitate comparison with Sri Lankan context.

A Finish study revealed that at the beginning of CLIL implementation, careful decisions need to be made on what is to be taught in the mother tongue and what can be taught through the foreign language. The study indicates that it takes time for learners to get the necessary skills of learning in a CLIL context (Jappienen, 2005). Yassin et al (2010) revealed through a study in Malaysian school science contexts that teachers posed questions were of lower cognitive order and teacher talk was very high preventing a satisfactory level of student talk. An intervention study carried out with pre-service teachers in Thai CLIL classrooms assigned to teach science revealed that they needed help from science teachers to plan science lessons. Further, it was observed that students communicated only in Thai although the teachers asked students to communicate only in English. However, the teachers were compelled to suggest that students may communicate in Thai as well. The study also indicates that the use of visual aids, ICT and hands-on activities helped the students to work collaboratively with the teacher asking simple questions in English. The study recommended that language support is necessary for students to work in a CLIL environment (Kwangsawad, 2018).

A widely accepted important factor for CLIL implementation is the teacher. Rodriguez (2018) highlighted that teaching flexibility as a competence would allow the teacher to adapt the professional skills to achieve successful and meaningful learning in students. Infante and Licona (2018) suggested that free and dynamic integration through trans-languaging is a linguistically responsive pedagogical approach for bilingual teaching and learning.

The Sri Lankan literature on CLIL is sparse and is only beginning to emerge. The basis of CLIL in Sri Lanka is that some content subjects are taught and learned in English which is not the mother tongue of the learners which is either Sinhala or Tamil. The need to revise the textbooks and other curricular materials for English medium instruction was highlighted in a study done by the National Education Commission Sri Lanka (Premaratne et al, 2014). A review of the curricular materials revealed the need to introduce a major revision of curricular materials focused on CLIL implementation as the contents being mere translations of monolingual curricular materials that are not appropriate to address the 4C's model (Nettikumara & Vithanapathirana, 2015).

5. Methodology

The study was conducted as collaborative action research. This action research was an effort by the postgraduate researcher who is a trained science graduate teacher and had studied in the English medium and also completed a Post Graduate Diploma in Teaching English as a Second Language (PGD in TESL) and her University Ph.D. supervisor who is a teacher educator in science education. The research student had gone through a short-term training in Content and Language Integrated Learning (CLIL) methodology conducted by the Education office of the region and the National Institute of Education, Sri Lanka.

The action research for the study was designed according to the model proposed by Kemmis and Mc Taggart (1988). This plan is comprised of the stages of planning, action, observing and reflecting. This research adopted the four stages as (i) planning (ii) intervention (iii) monitoring with facilitation and (iv) reflection. The planning stage focused on the gaining of access, fact-finding on the needs of the science teachers to conduct science lessons in bilingual modality and designing an intervention based on fact-finding. The action stage focused on the intervention led by the researchers to facilitate a change in CLIL implementation in the respective schools. The detailed activities to intervene to facilitate the improvement of CLIL lessons were developed after engaging in fact-finding with teachers. Hence, the detailed

activities are presented in section 6.2. Monitoring stage focused on the facilitation of the new CLIL lessons in sample schools with teachers. The final stage was to engage in reflection on the experience of conducting the intervention and on the data collected. This paper reports the cycle 1 of the action research.

This research was located in the educational zone in the northwestern part of the country in an area predominated by the fishing and tourism industries, where the research student had been a teacher for more than ten years. Since the bilingual stream is conducted by the provincial education authorities only in selected schools due to resource constraints, the school sample for the study was purposively selected to include four of the largest and high resourced schools in the zone and one semi-large school with moderate resources. All 15 teachers who were engaged in the bilingual stream were invited to participate. All teachers were females and however, only ten teachers consented to participate in the study. The others had reasonable personal reasons for not being able to participate. The sample included two teachers from each school. The ten teachers in the sample of participants had basic formal English language qualifications and on average 2-3 years of experience in teaching in the bilingual stream of study.

Data collection was done through observations, interviews and maintaining a record of self-reflections. Lessons of teachers were observed using a checklist based on 4C's CLIL model. A semi-structured observation schedule was also adopted to find out how the teachers facilitated their students to construct the meaning of their learning experiences using English language and acquire the necessary language skills learning science content. It was also attempted to understand how teachers promoted students' communication skills in order to develop their cognition through social interaction and how they paved the way for the students to use their cultural awareness for their concept formation process through experiential learning.

Interviews with teachers were mainly on teacher instructional guides and textbooks prepared for grades 6 to 11 by the National Institute of Education, Sri Lanka which is the body responsible for the curriculum development of the school education system and relevant textbooks prescribed to the bilingual stream by the Ministry of Education with a focus to see the compatibility based on the 4C's model and both syntactic and semantic aspects of language in relation to CLIL.

The data collected through different methods were triangulated to ensure the validity of findings generated through qualitative analysis of data collected on the research questions.

6. Results and Discussion

6.1. Needs of the teachers revealed through the fact-finding stage

With the permission and the encouragement from the Director of Zonal Education Office, research student met the principals of the selected schools to get their consent to conduct this action research in their schools. Research student explained the current situation of the bilingual programme conducted in Sri Lanka in detail and the problems encountered by the teachers and the bilingual learners. After having discussions and showing the interim action plan, the school principals consented to the research to be carried out in their schools. All five principles expressed their keenness to be included in the study as they understood that their bilingual teachers were being monitored and supported by a resource person who is knowledgeable about the field. At the same time, they emphasized that this work can be carried out with the consent of the teachers.

Fact-finding led to an understanding of the nature of the problems encountered by the teachers during science lessons in bilingual classes. The semi-structured interviews held with the teachers and the observation of their classroom teaching revealed that none of the teachers

had a clear conception regarding the CLIL concept. 08 teachers (80%) told that CLIL is equivalent to teaching in English medium. The teacher sample did not know the core principle of learning a subject and a language at the same time. All the teachers in the group indicated that they focused on giving the subject knowledge to their students either in the first language (L1) or in English (L2) as the need arose. Observation of 30 teaching plans, three from each teacher, revealed that none had considered the CLIL approach in writing science lesson plans for the bilingual stream. The following were the teacher perceptions regarding witting teaching plans.

- "*We usually write weekly plans not daily plans. So it is difficult to write a separate lesson plan for the bilingual class"*
- *"We have to teach parallel Sinhala medium classes so we write plans for both classes as a common plan"*
- *"It is time-consuming to focus on detailed lesson plans, and to get together to work as a group in the actual school setting is a problem"*

Teachers indicated that there were no special instructions for bilingual stream teachers in the curriculum materials and the textbooks were translations of subject texts books of mother tongue stream of study. In the discussions with the teachers, it was revealed that neither the integration of the four components of CLIL nor the linguistic aspects were given due significance. Teachers expressed that curriculum materials were unhelpful as neither the syllabi nor the textbooks had laid out or highlighted or emphasized a way to facilitate the integration of language to support language learning in students. It was observed that the syllabi comprised only science content knowledge and science pedagogical knowledge. The observations confirmed that textbook language deters students' understanding of the concepts as the translations were somewhat advanced for the students. Some effort to integrate the culture was observed with the homework assignments. The opportunities to integrate the students' experience to their culture through accepted forms of language during the classroom interactions were not observed.

6.2 Intervention-based on teacher needs

The intervention comprised of workshops with teachers focusing on CLIL based lesson planning at the zonal education office and school-based facilitation for the implementation of CLIL lessons. The first workshop focused on introducing the conceptual framework of CLIL. The second workshop focused on developing the learning outcomes of a CLIL lesson in collaboration with the teachers. CLIL lesson plans were developed during the third workshop by the teacher group. The fourth workshop was held after implementing the CLIL lessons for review and facilitation and the final workshop was held to reflect on the impact of the intervention. School visits were made by the researchers to observe the CLIL Science lessons and provide feedback. The data generation methods included lesson observations, interviews with teachers, analysis of teachers and researchers' self-reports and lesson material. The activity plan was as follows:

Planning
Activity 1: Negotiations with the principals and teachers to partner with the intervention
Activity 2: Fact-finding on the needs of teachers to design an intervention
Activity 3: Planning the Intervention

Intervention
Activity 1: Workshop 1 introduces the conceptual framework of CLIL
Activity 2: Workshop 2 develop learning outcomes to discuss the elements of CLIL lesson plan
Activity 3: CLIL lesson planning by teachers
Activity 4: Implementing new CLIL lesson plans by teachers in five schools

Monitoring with facilitation
Activity 1: School visits by the researchers for monitoring and facilitation
Activity 2: Workshop 3 for review and facilitation

Reflection
Activity 1: Workshop 4 to engage in reflections on the interventions

Figure 1. Action research process in developing CLIL instruction for secondary science

6.3 Interpreting the impact of lesson planning intervention

Teachers after engaging in group activities of perusing reading material on CLIL came-up with key ideas of 4Cs. They expressed their understanding as, integration of content across the curriculum through second language interaction while engaging learners through higher-order thinking, use of the second language in learning and mediation of ideas and interpreting the significance of content and language for successful citizenship.

Following teacher statements illustrate how the perception of the teachers changed after gaining an awareness of the concept of CLIL.

- *"Earlier I thought teaching Science in English is giving the subject knowledge only. Now I know that content and language are connected. Now I can write my lesson plans keeping that in mind."*
- *"It is difficult to find language outcomes. I need the help of somebody"*
- *"It is good if we have a supplementary workbook along with the textbook."*
- "*If we have a separate activity book just like a practical book then the students can keep it with them while doing the practical.''*

During collaborative CLIL lesson planning following steps were taken:

- Lessons were contextualized in authentic learning settings with teacher collaboration.
- Second language, English (L2) was integrated into the lesson by making an emphasis on fluency than on accuracy.
- Strong support was extended to teachers for integrating language structures with content by the researchers.

The following statements revealed the workshops and facilitation in the classroom lessons were instrumental to the change of the teachers' attitudes and efficacy of planning CLIL lessons was taking place.

- *"Though we did science lessons we did not write this type of lesson plans before. We just wrote only what we want to teach. I understand the importance of lesson plans. I also did not have an idea of CLIL methodology. This is the first time I learnt that we have to think of language also when we teach science."*
- *"When you first came to our school and talked to us about CLIL, I did not take it much seriously. I never thought these workshops would be something important like this. We like the lesson plans we all prepared. They are different. I also did not have any idea of CLIL. Now I know teaching is not easy. We have to learn the latest methods."*

7. Conclusion and recommendations

Although integration and implementation of CLIL principles were expected by the national curriculum implementation process through the bilingual teaching and learning in the secondary education sector of the country, it had not taken place effectively. Since there had not been an attempt to integrate CLIL principles to the teacher instructional manuals and the syllabi, the teachers face difficulties and are unable to engage in planning effective practices of content and language integration. It is widely agreed across the world that CLIL teaching requires a range of competences to yield successful outcomes from this complex educational approach. Hence, a systematic program should be implemented to revise the curriculum materials for the bilingual stream.

Providing an awareness of the theoretical principles of CLIL to the teachers enabled to motivate the teachers to adopt CLIL principles in lesson planning. An improvement of the teacher perceptions on the concept of CLIL resulted through supportive intervention. Therefore, it is recommended that in-service training workshops with hands-on activities should be designed and implemented by the education offices in the provinces.

Teacher education in CLIL at both pre- and in-service level needs to involve a range of programs which addresses a wide range of CLIL training needs such as supportive learning resources for both teachers and students for activities. Teachers should be trained to allow students to use both L1 and L2 in a flexible manner using appropriate levels of code-switching and trans-languaging pedagogies to acquire the advantages of bilingual education.

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