Teachers' Levels of Use of the 5E Instructional Model in the Implementation of Curriculum Reforms in Sri Lanka

[1]Fareed Mohamed Nawastheen, [1]Sharifah Nor Puteh and [2]Tamby Subahan Mohd. Meerah
[1]Centre of Excellence for Education and Learner Diversity, Faculty of Education,
[2]Faculty of Education, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia

Abstract: The 5E Instructional Model is an innovative approach for constructive classroom instruction. First introduced in competency-based curriculum reforms in Sri Lanka, this is an inquiry-based model that allows students to engage in the self-learning process in which teachers act as facilitators. The aim of this study was to assess the levels of teachers' participation (through levels of Use or LoU) in implementing the 5E instructional model in Sri Lanka. The Concerns-Based Adoption Model (CBAM) was used to identify teachers' LoU. Using the qualitative method, 9 out of 305 secondary school geography teachers from the Kalutara district were selected as respondents in this survey. Researchers used the basic interview protocol adopted from CBAM instruments. The results revealed that many teachers were either non-users or were at the initial stage of use. The overall results revealed that the use of innovation was unsatisfactory. Thus, these teachers must be engaged in training programs, provided with the necessary materials and resources and must be continuously monitored to help those who want to qualify for a user profile and those who want to move up into the higher user profiles.

Key words: 5E Instructional Model, Concerns-Based Adoption Model (CBAM), curriculum reforms, teachers' levels of use, geography teachers, Sri Lanka

INTRODUCTION

The 21st century arrived with so many innovations that have simultaneously taken place within the education systems throughout the world. Changing trends in the curriculum have been under way in both developed and developing countries for a decade (Roegiers, 2007). The curriculum reforms implemented by schools in the 21st century can be categorized as a transition from a behaviorist approach into a constructivist approach and from an objective to a competency or outcome-based approach. Jonnaert *et al.* (2007) stated that these reforms which are presently sweeping across education systems throughout the world, qualify in many cases as true paradigm revolutions given the magnitude of the transition from objective to competency-based pedagogy.

Sri Lanka is an island country in the Northern Indian Ocean off the Southern coast of the Indian subcontinent in South Asia. This country has a literacy rate of 92.5% and has one of the most literate populations amongst developing nations in the South Asia region and the rest of the world (De-Mel, 2007). Sri Lanka is highly acknowledged internationally for its achievements in literacy, educational enrolment, equal opportunity and access to education (Little, 2010). These significant achievements in education are made possible through government endeavors and provisions meant for education especially free education for >60 years after the country gained its independence. The contemporary structure of the education system is divided into six phases, namely, Pre School Education/ECCD, Primary Education, Junior Secondary Education, Senior Secondary Education, the Collegiate Level and the Tertiary Level. The report of NEC (2003) structured schools into grades as follows: Primary Grades 1-5 (Ages 5-9 years), Junior Secondary Grades 6-9 (Ages 10-13 years) and Senior Secondary Grades 10-13 (Ages 14-16).

In line with global trends, Sri Lanka introduced its first school curricular reforms of the new millennium in early 2007, referred to as the modernized competency based curriculum reform. These reforms were based on a constructive approach and have brought several innovations into the educational system such as revised competencies, the 5E learning cycle, activity plans and transformational roles for teachers and subject organization. The reforms have brought salient changes in terms of teaching competencies, changing roles of teachers, initiating new instructional approaches and

Corresponding Author: Sharifah Nor Puteh, Centre of Excellence for Education and Learner Diversity, Faculty of Education, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia

introducing new subjects. The reforms emphasized more active learning by urging teachers to change their teaching styles from transmission to transformational. In the context of developing skills for the 21st century, teachers are required to be facilitators and guides in a learning environment, rather than serve as mere purveyors of knowledge (Nawastheen and Puteh, 2012).

Literature review: The 5E Instructional Model, an inquiry-based approach, allows students to develop their own conceptual understanding via a series of experiences and inquiries. Through this model, the students are given the opportunity to learn through various activities structured by the teacher. As stated earlier, the model has five phases, including engagement, exploration, explanation, elaboration and evaluation. Each phase has a specific function and contributes to the coherent instruction of the teacher as well as to the students' formulation of a better understanding of scientific and technological knowledge, attitudes and skills. The model helps develop students' critical skills to help them adapt better to the demands of the 21st century, these include adaptability, complex communication or social skills, non-routine problem solving, self-management or self-development and systematic thinking (Bybee *et al.*, 2006).

The first phase of the 5E Model is engagement where in the teacher attempts to connect past and present knowledge regarding a concept. In this stage, the teacher uses various techniques to inspire interest and curiosity among students. In the exploration phase, students are allowed to work in groups, similar to cooperative learning activities, in order to gain common and concrete experiences. This phase helps students construct concepts and develop skills related to lesson. Students seek their own answers to problems and the teacher plays the role of a facilitator by providing necessary guidance (Goldston *et al.*, 2010; Campbell, 2006).

In the third phase, explanation, students come forward to describe their own understanding of the concepts being discussed using evidence to support their answers. The teacher introduces formal definitions and explanations of concepts by drawing upon the experiences of students during the exploratory activities (Goldston *et al.*, 2010). Elaboration is the fourth phase wherein students are provided opportunities to apply and extend the concepts and skills in new but related situations. Sometime, students may have misconceptions about the topics. To solve this, the activities are designed in such a way that they can help students correct their remaining misconceptions and generalize the concepts in a broader context (NSTA, 2006). The last phase is

evaluation wherein the teacher evaluates the students' understanding of concepts, the skills they developed, ability to apply the concepts learned and changes in their thinking. Although, this phase is indicated as the last one in the 5E Model, assessment and evaluation can take place throughout the learning and teaching process.

The 5E Model enables students to analyze and synthesize new information in constructivist classrooms. It is the most practical model in the constructivist approach for learning. Earlier research on the use of the 5E instructional application in teaching various subjects have found that this is more effective compared with traditional methods in developing conceptual understanding among students (Yalcin and Bayrakceken, 2010; Turk and Calik, 2008; Hanuscin and Lee, 2008; Akar, 2005). The 5E Model was first adopted into the curriculum reforms in Sri Lanka in 2007 during which it was used as the main pedagogical approach for teaching all subjects in the secondary school curricula, thus, helping students attain desired learning outcomes and develop 21st century skills.

Teachers are the most crucial factors that influence the success of any educational change in an individual (Fullan, 2007). Moreover, teachers are the key to the success of curriculum reform (Bantwini, 2010). Ma *et al.* (2009) claimed that many researchers have discovered the significant role of teachers during curriculum reform. Flores (2005) also noted that teachers are crucial elements because they are the individual agencies that attempt to implement changes in a curriculum. Therefore, efforts must be made to engage teachers in the change process (Marsh, 2002). Furthermore, they must be periodically evaluated during a curriculum change process. Given that teachers are the critical agents for bringing changes into their classrooms, they should be the major focus of analysis and sources of evidence regarding the introduction of curriculum reform (Anthony, 2008). Therefore, apart from studying the curriculum that has been planned and its manner of implementation, it is also important to examine the concerns of the teachers, their levels of use and the fidelity of their implementation of the 5E Model. Nor Puteh and Nawastheen (2013) evaluated the stages of teachers' concerns and suggested the need to investigate their levels of use and fidelity of implementation. Therefore, the present study aims to focus on the teachers' levels of use of the 5E Instructional Model during the implementation of curriculum reforms in Sri Lanka, specifically in teaching geography.

The conceptual framework: Recently, the Concerns-Based Adoption Model (CBAM) has been recognized as an effective approach for evaluating the

Table 1: LoU in curriculum change

Groups	Levels	Description
NON-USE	Level 0: Non-use	Teacher does not take any action with regards curriculum change
	Level I: Orientation	The teacher looks for more information about the curriculum change
	Level I: Preparation	The teacher gets ready to practice the curriculum change for the first time at the classroom
USE	Level III: Mechanical use	The teacher displays poorly coordinated application of curriculum reforms and only makes user-oriented changes
	Level IVA: Routine	The teacher applies the curriculum changes with few or no changes and sticks to an established pattern of use
	Level IVB: Refinement	The teacher makes changes to the curriculum reforms to increase outcomes
	Level V: Integration	The teacher exerts extra effort to coordinate with other teachers regarding the application of curricular changes
	Level VI: Renewal	The teacher looks for more effective alternatives to the established application of curricular changes

Adaptive from Hall (2010)

curriculum implementation process. Donovan *et al.* (2007) stated that CBAM not only provides a framework and essential tools to the researchers but also focuses on the individuals responsible for implementing the change at the classroom level. In the 1970s, of the Research and Developmental Centre for Teacher Education (RDCTE) developed CBAM and its diagnostic tools at the University of Texas in Austin. The CBAM was based on the RDCTE concepts of concern development and continuous follow-up studies which were earlier developed by Fullers (George *et al.*, 2006).

CBAM was built based on several conclusions about change which can be viewed as a process rather than an event. The success of change requires an understanding of one basic idea: that change occurs over time, usually a period of several years. Notably, individuals facilitate change and change affects the people involved. Thus, the roles played by those involved during the change process should be considered the primary focus in any implementation effort. These people may react differently and the success of any change that has been initiated must be measured based on individual skills and experiences. Change incorporates developmental growth that tends to shift as the individuals involved become more familiar with the innovation through experience.

Moreover, change is best conceptualized and understood in operational terms. In the case of teachers, this means understanding how the change process can affect their classroom practices (Hord *et al.*, 2006). The CBAM is comprised of three dimensions that address change: Stages of Concern (SoC), Innovation Configuration (IC) and Levels of Use (LoU). SoC is the hallmark of CBAM theory and provides a framework for understanding the nature of the change process in terms of the individuals engaged in implementing an innovation (George *et al.*, 2006). IC focuses on the outcome of the innovation which varies according to individuals in charge of implementing the innovation from different contexts. Likewise, the use of any innovation also varies from one individual to another because individuals use innovation in various ways. LoU is another CBAM dimension that describes the level in which teachers use an innovation. LoU focuses on the knowledge, skills and behaviors of an individual's involvement in change. This CBAM dimension focuses solely on the behaviors of innovation users and does not address attitudinal, motivational or other aspects (Hord *et al.*, 2006).

The present study employed LoU because it focused on the intensity of the teachers' implementation of the 5E Model in teaching geography. Only the LoU dimension of CBAM was used. Eight distinct LoU behavioral profiles were identified and operationally defined in the research (Kwarteng, 2009) (Table 1).

These profiles and their behavioral characteristics are observable. These profiles also explain the capabilities of an individual or group during the implementation process. In addition, LoU has seven categories: knowledge, acquiring information, sharing, assessing, planning, status reporting and performing (Hall *et al.*, 2006). These categories represent subparts of each LoU, define each LoU and represent a more detailed description of LoU; they also make having multiple data points for determining LoU possible and allow each category to be rated separately (Hall *et al.*, 2006). Moreover, the combination of ratings can then be used to determine the overall LoU.

MATERIALS AND METHODS

Aim and objectives: The purpose of the study was to assess the teachers' LOU of the 5E Instructional Model as they participated in implementing curricular reforms in Sri Lanka. Specifically, the objectives were as follows: to determine teachers' LoU in implementing the 5E instructional approach in their classrooms; to identify the differences in teachers' LoU in terms of medium of instruction, school location, school type, teachers' experience and teachers' qualifications.

Research questions: The study focused on two research questions: What are the teachers' LoU when they implement the 5E instructional approach in their classrooms? and What are the differences in teachers'

Table 2: Sample distributions across demographic variables

Parameters	Cases								
	1	2	3	4	5	6	7	8	9
Medium of instruction	Sinhala	Sinhala	Sinhala	Sinhala	Sinhala	Tamil	Tamil	Tamil	Tamil
Location	Urban	Rural	Rural	Urban	Rural	Urban	Rural	Rural	Urban
Type of school	1AB	1AB	T2	1C	1C	1AB	1C	T2	1C
Experience (years)	10 and above	1-9	1-9	1-9	10 and above	10 and above	1-9	1-9	1-9
Qualification	M.Ed.	B.A.	B.A.	B.A.	M.Ed.	M.A.	B.A.	PGDE	B.A.

LoU in terms of medium of instruction (Tamil and Sinhala), school location (Urban and Rural), school type (1AB, IC and type 2), teaching experience (>10 years and <10 years) and qualifications?

Population and sample: The participants consisted of geography teachers from 305 schools in the same district. They were teaching grade 9 in secondary schools located at the Kalutara district of Sri Lanka. A total of 303 teachers took part in a survey regarding the concerns of teachers which was used in a similar study by Nor Puteh and Nawastheen (2013). The present study was administered to 9 teachers (5 Sinhala and 4 Tamil) who expressed the highest concerns in the survey. They were selected for assessing teachers' LoU in implementing the 5E Model in their respective schools. The respondents represented different types of schools, experiences, locations as well as academic and professional qualifications. Table 2 shows the distributions of the sample selected for the study.

Apart from the distribution of the sampled teachers according to their medium of instruction, four teachers were from urban schools whereas the remaining five were from rural schools (Table 2). Meanwhile, three teachers were from 1AB schools, two were from type 2 schools and four teachers were from 1C schools. The experiences of the selected teachers vary: three teachers had 10 years or more of teaching experience whereas six had <10 years of experience. However, when academic qualifications were taken into consideration, three teachers had postgraduate qualifications and the rest had graduate certificates.

Instrument: The qualitative approach and interviews were employed to assess teachers' LoU. The basic interview protocol of CBAM was adopted in the study with some modifications. The protocol was translated into the local languages of Sinhala and Tamil so that it can be adapted in the local context and content of the study. Language experts were asked to edit the translated version. CBAM researchers have already established the validity and reliability of the instrument (Hall *et al.*, 2006). However, four experts were asked to rate both versions according to the Cohen's Kappa index. The overall ratings showed that

the adopted instruments have a Cohen's Kappa index close to 0.90. The results also showed that the translated interview protocol has acceptable reliability for assessing teachers' LoU according to the study sample.

Data analysis: Interviews were conducted with the selected nine teachers using both mediums. All interviews were recorded using a recorder and then rated later on. Statements obtained from the interviews were analyzed according to specified CBAM procedures. Hall *et al.* (2006) provided guidelines for analyzing the statements of the respondents. Rating sheets were used to tally the statements of the teachers and to determine their overall LoU. The rating sheets later determined their LoU across the seven categories. Both the interviews and the rating process were used to determine the teachers' LoU.

RESULTS AND DISCUSSION

RQ 1 (What are the teachers' LoU in implementing the 5E instructional approach in their classrooms?) Results of the interviews revealed each teacher's LoU in implementing the 5E instructional model in their teaching process. These results were subsequently analyzed.

LoU of case 1: Case 1 uses Sinhala to teach at a 1AB urban school in the district. He is an experienced geography teacher in secondary school and has been teaching for over 10 years. He holds a Bachelor's degree and a Master's degree in Education. He revealed that he used the 5E instructional model in the classroom. After analyzing his interview, researchers placed him in the early stage of using the innovation. Table 3 shows the category of case 1 in terms of using the innovation.

The descriptions above also depict the overall LoU of case 1 when implementing the 5E Instructional Model in the classroom. He describes the 5E Model as a good approach that makes students enthusiastic, motivated and cooperative during the learning process. However, he also describes the difficulties involved in implementing the new 5E Model such as inadequate time allocation, insufficient resources and inadequate time for completing the daily lesson plans.

Table 3: Summary of the LoU of case 1

Category	Interpretation of category	LoU
Knowledge	Focused on day to day aspects in using the innovation. The teacher knew about the models' strengths and weaknesses and was able to describe how the model helped the students learn and how it increased the teacher's effectiveness. Case 1 focused on the short-term aspects of using the innovation rather than the long-term ones	III
Acquiring information	Sought more information on using the 5E Model within 40 min instead of 80 min	III
Sharing	Discussed the difficulties of obtaining materials and resources as well as the inadequate space in classrooms for using innovation. He also discussed sharing experiences and materials with others	III
Assessing	Carried out observations on the achievements of students and his abilities	II
Planning	Intended to attend more training programs and sought activities for obtaining required materials and resources for the initial use of the 5E Model	II
Status reporting	Sought time management in using the 5E Model as well as in obtaining the required materials and resources for better use of the 5E Model in schools	III
Performance	Did not seek any changes in the innovation and worked with others in obtaining help in preparing activity plans and necessary materials	III
Overall LoU	Knew the importance of the 5E Model and focused on short-term activities in using the model. Required some changes for the needs of the students	III

Table 4: Summary of the LoU of case 2

Category	Interpretation of category	LoU
Knowledge	Had limited understanding of the 5E Model. Discussed with other teachers to acquire knowledge and experience as well as required materials	II
Acquiring information	Sought more information on the 5E Model. Obtained more information about the 5E Model from senior teachers	II
Sharing	Shared own ideas about difficulties in using the 5E Model such as insufficient time and shared their materials and resources among teachers	II
Assessing	Occasionally carried out informal evaluations to examine the influence of the 5E Model on the learning of students and examine the strategies of the teacher	II
Planning	Expected to use the model within 40 min by reducing prescribed activities stated in the guidelines. The teacher planned to work with other teachers to prepare creative activity plans and exchange resources among them	III
Status reporting	Expressed that the time to carry out the activities of 5E Model was insufficient. The teacher was willing to creatively use the 5E Model in the future by obtaining the required materials and resources	III
Performance	The teacher needed to understand the teacher guide in depth and must undertake further training so that he can better utilize the 5E Model	II
Overall LoU	The teacher had limited knowledge of the 5E Model and its effects on the students and teachers. He must obtain more information and materials on the 5E Model for initial use	II

LoU of case 2: Case 2 uses Sinhala at a 1AB rural school in the district. He is an experienced teacher and has been teaching in secondary school for 5 years. He possesses a Bachelor's degree in arts and is currently pursuing a post-graduate diploma in education. He expressed that he uses the 5E Model in the classroom. However, upon analyzing his interview, researchers placed him in the preparation level in many categories except in the planning and status reporting levels wherein case 2 is categorized into the mechanical LoU phase. Table 4 shows a summary of the LoU of case 2.

LoU of case 3: Case 3 uses Sinhala at a rural type 2 school in the district. He has >5 years of experience teaching at a secondary school and holds a Bachelor of Arts degree. Based on the interview, researchers placed him in the initial stage of the LoU in adopting the 5E Instruction Model. A summary of his LoU is given in Table 5.

LoU of case 4: Case 4 uses Sinhala at an urban 1C School. He is a graduate teacher who has been teaching at a

secondary school for 7 years. Researchers placed him in the mechanical level in many categories. Table 6 shows a summary of LoU of case 4.

LoU of case 5: Case 5 uses Sinhala to teach at 1C rural school in the district. He has over 10 years of experience teaching in secondary school. Case 5 holds a postgraduate diploma and a Master's Degree in education. Researchers categorized case 5 into the routine stage in many categories as described in Table 7.

LoU of case 6: Case 6 uses Tamil to teach at a 1AB urban school in the district. He has 12 years of teaching experience. He holds a Master's degree in education. Researchers categorized him into the routine LoU in many categories. Table 8 gives a brief description of his LoU.

LoU of case 7: Case 7 uses Tamil to teach at a rural type 1C School in the district. Case 7 has 2 years of experience in teaching at a secondary school and possesses a Bachelor of Arts degree. Researchers placed him in the preparation level in all categories. Table 9 shows a summary of his LoU.

Table 5: Summary of the LoU of case 3

Category	Interpretation of category	LoU
Knowledge	Knew the 5E Model better than others who were at LoU II. Focused on short-term aspects in using the 5E Model but uncertain regarding the implementation of the 5E Model in the long run	III
Acquiring information	Sought more information about the 5E Model to improve usage. Expected such information from senior teachers	II
Sharing	Mostly discussed materials and resources for better use of the 5E Model. Shared own ideas and knowledge about the model and exchanged class time with others to complete teaching using the 5E Model	II
Assessing	Knew some of the effects of the 5E Model on students and teachers. Occasionally carried out informal evaluations	II
Planning	Planned to obtain additional resources and materials for the 5E Model	II
Status reporting	Showed no attempt to change the ways be which he used the 5E Model. Sought additional resources and meaningful training for better use of the 5E Model	II
Performance	Intended to use the 5E Model as prescribed in the guide. However, he must obtain an in-depth understanding of the guide with the help of other teachers	II
Overall LoU	Knew about the 5E Model and its effectiveness. However, he must obtain further information and resources regarding the initial use of the 5E Model	II

Table 6: Summary of the LoU of case 4

Category	Interpretation of Category	LoU
Knowledge	Had a clear understanding of the 5E Model. Concerned with day to day activities using the 5E Model. Obtained support from other teachers in solving issues related to using the 5E Model	III
Acquiring information	Sought more information about the 5E Model and the many ways by which to organize activities within the allocated time	III
Sharing	Discussed with other teachers about the effectiveness and managerial issues related to the use of the 5E Model	III
	Shared own class hours with other teachers to complete their teaching activities using the 5E Model	III
Assessing	Carried out informal evaluations and examined how students managed their own use of the 5E Model	
Planning	Spoke to the principal about obtaining necessary materials and resources for better use of the 5E Model. He intended to work with others to gain knowledge and resources	II
Status reporting	Did not attempt major modifications but carried out the first three stages of the 5E Model because of limited time allotted for lessons	III
Performance	Worked with others to understand the provided materials such as the Teacher Instructional Manual and other notes given during training sessions, to obtain a better understanding of the 5E Model	II
Overall LoU	Knew about the 5E Model more than others but focused on short-term aspects in using the model. Sought changes to meet the needs of teachers	III

Table 7: Summary of the LoU of case 5

Category	Interpretation of category	LoU
Knowledge	Knew about the 5E Model and its impact on the cognition and behavior of students than other teachers. Focused on both the short and long-term aspects related to the use of the 5E Model	IVA
Acquiring information	Did not seek additional information because he already collected required materials and resources	IVA
Sharing	Told other teachers about the benefits of using the 5E Model in their teaching. Shared own experiences and materials with other teachers	III
Assessing	Carried out informal evaluations and cooperated with senior teachers to conduct formal evaluations on the use of the 5E Model	IVA
Planning	Prepared all required activities and materials for future use of innovation but still required some modifications on such activities. However, he worked with others in sharing own materials and experiences	III
Status reporting	Showed no attempt to change own use of the 5E Model. Prepared all required activities for the use of the 5E Model in the future	IVA
Performance	Used the 5E Model as prescribed in the teacher guide. Shared own experiences and knowledge about the 5E Model with other teachers	III
Overall LoU	Seemed to be stable in terms of the ability to use the 5E Model. Knew more about the 5E Model than other teachers Established in the use of the 5E Model with all required materials and resources prepared in advance	IVA

LoU of case 8: Case 8 also teaches using Tamil at a rural type 2 School in the district. Case 8 has 7 years of experiences teaching at secondary school and holds a post-graduate diploma in education. Case 8 is currently not using the 5E Model. After analyzing his interview, researchers placed him in the level of mechanical use at the knowledge category and in the preparation level at other categories. A summary of his LoU is shown in Table 10.

LoU of case 9: Case 9 uses Tamil to teach at an urban type 1C School in the district. He has 6 years of experience teaching at a secondary school. Case 9 is a trained teacher and holds a Bachelor of Arts degree. In terms of using the 5E Model, researchers placed him in the preparation level in all categories. Table 11 summarizes the LoU of case 9.

Table 12 shows the LoU of each respondent according to the seven LoU categories. This Table 12 deepens the understanding of each respondent's LoU in implementing the 5E Instructional Model.

The seven categories of LoU are presented in Table 12 in which each column indicates an individual profile level. An analysis of the results revealed that the

Table 8: Summary of the LoU of case 6

Category	Interpretation of category	LoU
Knowledge	Knew about the 5E Model in detail and focused on the short term-aspects of using the 5E Model	III
Acquiring information	Possessed all required materials for using of the 5E Model. Obtained assistance from senior teachers in solving issues	IVA
Sharing	Discussed with other teachers regarding managerial issues related to the 5E Model. Shared own experiences and materials with colleagues	III
Assessing	Carried out informal evaluations and cooperated with local authorities to conduct formal evaluations on their use of the 5E Model	IVA
Planning	Intended to use own activities instead of prescribed activities in the guide for better use of the 5E Model	IVA
Status reporting	Had no need for additional information on the 5E Model because creative rather than prescribed activities were already being used	IVA
Performance	Had a good grasp of using the 5E Model while teaching. Worked with others to share knowledge, experiences and materials with colleagues	III
Overall LoU	Focused on both the short and long-term aspects and established in some extent in using the 5E Model	IVA

Table 9: Summary of the LoU of case 7

Category	Interpretation of category	LoU
Knowledge	Knew about the 5E Model and its impact on teachers and students to some extent. Focused on collecting materials and resources to better understand the 5E Model	II
Acquiring information	Sought more information on the 5E Model. Worked with others to obtain required materials and resources	II
Sharing	Discussed with other teachers mostly regarding resources and required materials for initial use of the 5E Model	II
Assessing	Occasionally carried out informal evaluation. Focused on the needs of students when using the 5E Model	II
Planning	Sought more training and materials for using the 5E Model. Was new to the innovation and planned to work with other teachers to better understand the use of the 5E Model	II
Status reporting	Willing to use the 5E Model as prescribed in the guide	II
Performance	Worked with senior teachers to understand the guides in depth for the initial use of the 5E Model	II
Overall LoU	Currently prepared for the initial use of 5E Model. Focused on obtaining more materials and resources for better use of the 5E Model	II

Table 10: Summary of the LoU of case 8

Category	Interpretation of category	LoU
Knowledge	Knew about the 5E Model to some extent. Focused on short-term activities in using the 5E Model	III
Acquiring information	Sought more materials and resources as well as further training on the use of the 5E Model	II
Sharing	Spoke with other teachers about the 5E Model, mostly about difficulties in obtaining the required materials and resources for the use of the model	II
Assessing	Carried out informal evaluations and listed necessary materials and resources for the use of the 5E Model	II
Planning	Planned to use the 5E Model in the teaching process. Intended to work with others to obtain required materials and resources for better use of the model	II
Status reporting	Does not currently use the 5E Model because of a lack of resources. Collecting all required materials and resources to start using the 5E Model	II
Performance	Needed some time to understand the guides about the 5E Model. Obtained assistance from other teachers for this problem	II
Overall LoU	Currently preparing to use the 5E Model to teach. Sought additional training and required resources to use the 5E Model	II

Table 11: Summary of the LoU of case 9

Category	Interpretation of category	LoU
Knowledge	Understood the 5E Model and its impacts on students and teachers. Worked with others to obtain more knowledge and experience	II
Acquiring information	Sought more information and additional training on the use of the 5E Model	II
Sharing	Discussed with other teachers about issues related to the 5E Model and shared materials with others	II
Assessing	Observed the performance of students when using the 5E Model. Showed concern in relation to the required materials and resources for increasing student achievements	II
Planning	Intended to attend more workshops to allow him to use the 5E Model effectively	II
Status reporting	No attempt to make major changes in using the 5E Model. Sought necessary materials to initiate effective use of the 5E Model	II
Performance	Used the 5E Model as prescribed in the guides but must be given more time understand the instructions given in the guides	II
Overall LoU	Still gathering required materials and resources for initiating the 5E Model in teaching	II

profiles of the interviewed teachers ranged from LoU II to IVA of all the categories. At the knowledge category, three teachers remained in LoU II, five teachers remained in LoU III and one teacher remained at LoU IVA. Teachers at the LoU II knowledge category had a clear understanding of the 5E Model and how it should be carried out. They described how their roles in the classrooms changed and how the 5E Model affected them and their students. At the same time, they had complaints regarding the limited time for preparation and continuing activities as well as the lack of resources and materials for implementing the 5E Model.

Table 12: Respondents' LoU according to the categories

Teacher Id	Knowledge	Acquiring information	Sharing	Assessing	Planning	Status reporting	Performing	Overall LoU
Case 1	III	III	III	**II**	**II**	III	III	III
Case 2	II	II	II	II	**III**	**III**	II	II
Case 3	**III**	II	II	II	II	II	II	II
Case 4	III	III	III	III	**II**	III	**II**	III
Case 5	IVA	IVA	**III**	IVA	**III**	IVA	**III**	IVA
Case 6	**III**	IVA	**III**	IVA	IVA	IVA	**III**	IVA
Case 7	II	II	II	II	II	II	II	II
Case 8	**III**	II	II	II	II	II	II	II
Case 9	II	II	II	II	II	II	II	II

*Bold face values indicate the different categories of teachers who remained in other overall LoU

Teachers with a knowledge category of LoU III described the 5E Model in detail better than others who were at LoU II. The teacher at the LoU IVA knowledge category suggested both short and long-term activities for the implementation of the model. At the stage of acquiring information about the 5E Model, five teachers at the LoU II level were involved in acquiring information about the 5E Model especially about the elaboration and evaluation stages of 5E. They felt that receiving training and materials such as the syllabi and teacher guides were insufficient for the continuous use of the 5E Model. Thus, they sought information and guidance from experienced teachers in their school level. The two teachers at the LoU III level reached the information stage by seeking management-related information such as how the 5E Model could be used effectively within 40 min. Similarly, two teachers remained at the acquiring information stage of the LoU IVA. They did not expect any more information about the 5E Model because they already had enough information about the model. The sharing category focuses on what kind of things could be shared among the teachers. An analysis of the results showed that five teachers were at the sharing category of LoU II and four teachers were at LoU III.

Teachers at LoU II were more interested in discussing resources, materials and issues related to time management in the 5E Model. In addition, those who remained at LoU III discussed how they overcame issues such as managing time and obtaining materials and resources. The assessment category is about how teachers evaluate students when teachers use an innovation. An analysis of the results revealed that six teachers were at LoU II of the assessing category, one teacher was at LoU III and two teachers remained at LoU IVA of the assessing category. Teachers at LoU II of the assessing category carried out informal evaluations and observations when deciding how to use the 5E Model. In contrast, only two teachers at LoU IVA stated that they cooperated with experienced teachers for formal evaluations in order to determine their use of 5E in their classrooms.

Meanwhile, the planning category identifies efforts and activities for using innovation in the future. Six teachers remained at LoU II of the planning category, two were at LoU III and one teacher was at LoU IVA. The results revealed that many teachers were at the initial use of innovation and still thought about how they can obtain resources and materials for using the 5E Model. Moreover, teachers who remained at LoU III of the planning category only described prospective, short-term plans.

Next, the status reporting category summarizes the use of innovation and the ways by which individuals perceive their use of innovation. In this category, four teachers were at LoU II, three teachers were at LoU III and two teachers were at LoU IVA. Teachers in LoU II expressed their interest in using 5E whereas teachers at LoU III described their difficulties in using the 5E Model due to inadequate time, resources and materials. Likewise, teachers who were at LoU IVA represented their use of innovation because they satisfactorily implemented the 5E Model even though they experienced managerial issues.

Finally, the performing category describes actual situations wherein teachers use innovation. Table 6 shows that the majority of teachers remained at LoU II in this category. The teachers at this level stated that they understood the materials and organized related activities when using the 5E Model. Only three teachers were at LoU III of the performing category and they used the 5E Model without expecting any immediate results.

RQ 2 (What are differences in teachers' LoU in terms of medium of instruction, location of schools, type of schools, teachers' experiences and teachers' qualifications?) To answer RQ2, the teachers' LoU was assessed based on their medium of instruction, school location, school type, experience and qualification. The results are shown in Table 13.

The results revealed that teachers who taught in Tamil were at LoU II in terms of the preparation profile compared with those who taught in Sinhala. Two teachers

Table 13: Differences in LoU based on demographic variables

Overall LoU	Medium		Location		Type			Experience		Qualification	
	Sinhala	Tamil	Urban	Rural	IAB	IC	T2	≥10 years	≤10 years	Graduate	PG
II	2	3	1	4	1	2	2	0	6	5	0
III	2	0	2	0	1	1	0	1	0	1	1
IVA	1	1	1	1	1	1	0	2	0	0	2

who taught in Sinhala were at LoU III and one teacher was at the LoU IVA whereas only one teacher who taught in Tamil and used the 5E Model was at the routine profile. Furthermore, more rural teachers were at the preparation level, two urban teachers remained at the mechanical level and one remained at the routine level.

In terms of school type, few differences were observed regarding the range of teachers' LoU from preparation to routine profiles. A teacher from a 1C school and another from a type 2 school were at the preparation level. Teachers from 1AB schools ranged from the preparation to the routine profiles of LoU. With regards the experience of teachers, a significant difference was observed in that all teachers who had <10 years of experience were at the preparation profile of LoU, the two teachers who had >10 years of experience were at the routine profile while and one teacher was at the mechanical profile of LoU. Regarding the qualifications, differences between teachers with graduate and post-graduate degrees were also observed. All graduate-degree holders, except one, remained at the preparation profile of LoU whereas one post-graduate teacher remained at the mechanical profile. Two teachers remained at the routine profile of LoU.

CONCLUSION

The 5E Model was introduced during the competency-based curriculum reforms in Sri Lanka to enhance the students learning and skills within a constructivist classroom. Many teachers were aware of the 5E Model and quite a number of showed more concern in implementing the model (Nor-Puteh and Nawastheen, 2013). Therefore, this study attempts to examine how teachers practice the use of the 5E Model in their respective classrooms. The present study employed LoU, a dimension and tool of CBAM, to assess the actual practice of nine teachers. The results revealed that the majority of teachers were either non-users or at the LoU-preparation profile. Moreover, a small number of teachers remained at the LoU III-Mechanical profile and at the LoU IVA-Routine profile. In addition, differences in using the 5E Model were observed in terms of medium of instruction, school location, school type, teachers' experience and teachers' qualifications. The overall results suggested that the introduction of the 5E Model

in the curriculum reform was unsatisfactory because the majority of the teacher had profiles that indicated they were either non-users or were at the preparation level. Therefore, teachers must join training programs must be provided with the necessary materials and resources and must be continuously monitored to ensure proper use of the 5E Model. These suggestions may help teachers who want to qualify for a user profile and those who want to move up into the higher user profiles.

REFERENCES

Akar, E., 2005. Effectiveness of 5E learning cycle model on student understanding of Acid-Base Concepts. Ph.D. Thesis, Middle East Technical University.

Anthony, L.W.L., 2008. Teacher concerns about curriculum reform: Eacher concerns about curriculum reform: The case of project learning. Asia-Pacific Educ. Res., 17: 75-97.

Bantwini, B.D., 2010. How teachers perceive the new curriculum reform: Lessons from a school district in the Eastern Cape Province, South Africa. Int. J. Educ. Dev., 30: 83-90.

Bybee, R.W., J.A. Taylor, A. Gardner, P. van Scotter, J.C. Powel, A. Westbrook and N. Landes, 2006. The BSCS 5E instructional model: Origins and effectiveness. A Report Prepared for the Office of Science Education National Institutes of Health, Colorado.

Campbell, M.A., 2006. The effects of the 5E learning cycle model on students' understanding of force and motion concepts. Ph.D. Thesis, University of Central Florida Orlando, Florida.

De-Mel, T., 2007. Stop tinkering with our education. The Sunday Times Online:, Vol. 42, No. 27, Wijeya News Papers Ltd., Colombo.

Donovan, L., K. Hartley and N. Strudler, 2007. Teacher concerns during initial implementation of a one-to-one laptop initiative at the middle school level. J. Res. Technol. Educ., 39: 263-286.

Flores, M.A., 2005. Teachers' views on recent curriculum changes: Tensions and challenges. Curriculum J., 16: 401-413.

Fullan, M., 2007. The New Meaning of Educational Change. 4th Ed., Teachers College, Columbia University, New York and London.

George, A.A., G.E. Hall and S.M. Stiegelbauer, 2006. Measuring Implementation in Schools: The Stages of Concern Questionnaire. 2nd Edn., SEDL, Austin, Texas.

Goldston, M.J., J.B. Day, C. Sundberg and J. Dantzler, 2010. Psychometric analysis of a 5E learning cycle lesson plan assessment instrument. Int. J. Sci. Math. Educ., 8: 633-648.

Hall, G.E., 2010. Technology's Achilles heel: Achieving high-quality implementation. J. Res. Technol. Educ., 42: 231-253.

Hall, G.E., D.J. Dirksen and A.A. George, 2006. Measuring implementation in schools: Levels of use. Southwest Educational Development Laboratory, Pages: 98.

Hanuscin, D.L. and M.H. Lee, 2008. Using the learning cycle as a model for teaching the learning cycle to preservice elementary teachers. J. Elementary Sci. Educ., 20: 51-66.

Hord, S.M., S.M. Stiegelbauer, G.E. Hall and A.A. George, 2006. Measuring implementation in schools: Innovation configurations. Southwest Educational Development Laboratory, Austin, Texas, Pages: 73.

Jonnaert, P., D. Masciotra, J. Barrette, D. Morel and Y. Mane,7 2007. From competence in the curriculum to competence in action. Prospects, 37: 187-203.

Kwarteng, J.T., 2009. Status of accounting curriculum implementation: A Concerns-based adoption model assessment in ashanti and central regions. M.Sc. Thesis, University of Cape Coast.

Little, A.W., 2010. The politics, policies and progress of basic education in Sri Lanka. CREATE, Centre for International Education.

Ma, Y.P., H.B. Yin, L.F. Tang and L.Y. Liu, 2009. Teacher receptivity to system-wide curriculum reform in the initiation stage: A Chinese perspective. Asia Pacific Educ. Rev., 10: 423-432.

Marsh, C.J., 2002. Engaging the hearts and minds of teachers in curriculum reform. Proceedings of the 1st Conference of Asia Pacific Curriculum Policy Makers, November 15-16, 2002, Hong Kong.

NEC, 2003. Envisioning education for human development: Proposals for a national policy framework on general education in Sri Lanka. National Education Commission, Colombo, Sri Lanka.

Nawastheen, F.M. and S.N. Puteh, 2012. Teachers' concerns in the implementation of 5E instructional model in Sri Lanka. Proceedings of the 3rd International Conference on Learner Diversity, September 18-20, 2012, Universiti Kebangsaan Malaysia.

Nor Puteh, S. and F.M. Nawastheen, 2013. An evaluation on the implementation of 5E instructional model in teaching geography in Sri Lanka. Middle-East J. Scient. Res., 16: 721-728.

Roegiers, X., 2007. Curricular reforms guide schools: But, where to? Prospects, 37: 155-186.

Turk, F. and M. Calik, 2008. Using differnt conceptual change methods embedded within 5E model: A sample teaching of Endothermic-exorhermic reactions. Asia-Pacific Forum Sci. Learn. Teach., Vol. 9.

Yalcin, F.A. and S. Bayrakceken, 2010. The effect of 5E learning model on pre-service science teachers' achievement of acids-bases subject. Int. Online J. Educ. Sci., 2: 508-531.