GLOBUS PUBLICATION

Globus Journal of Progressive Education
A Refereed Research Journal
Vol 13 / No 2 / Jul-Dec 2023 P - ISSN: 2231-1335, E- ISSN: 2582-7200

APPLICATION OF THE COMPETENCY-BASED EDUCATION IN SECONDARY SCHOOL MATHEMATICS EDUCATION IN SRI LANKA

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Paper Received: 13.08.2023 / **Paper Accepted**: 10.09.2023 / **Paper Published**: 16.09.2023

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Abstract

A well-structured education system in a country aims to build up a well-informed and knowledgeable community fully equipped with 21st-century skills, which in return will contribute positively towards the development of the country. In this context, mathematics education is vital in enhancing a person's analytical and problem-solving abilities. A new competency-based education system was introduced in Sri Lanka in 2007 to create individuals who can think mathematically and apply mathematical knowledge effectively and responsibly in problem-solving and decision-making. This study aims to explore the level of preparation the teachers received in applying competency-based education (CBE) in the teaching-learning process of mathematics in Sri Lanka. In this quantitative study, the data was collected from 276 teachers of mathematics who teach middle school in the Western Province of Sri Lanka, using a well-structured questionnaire. The results revealed that teachers need more training to apply CBE in the teaching-learning process of mathematics. Also, insufficient monitoring and continuous professional development hinder the application of CBE in the teaching-learning process of mathematics. The findings suggest continuous professional development exercises such as lesson study be offered by experts in CBE to the teachers with ample hands-on tasks. Also, to monitor the ongoing teaching-learning process to ensure the competency of the teachers in applying the CBE effectively in the mathematics classrooms in Sri Lanka. The aspects discussed here would benefit the administrators and teachers to enhance the mathematics teaching-learning process. Also, it would benefit researchers to identify approaches to enhance the quality of mathematics education in Sri Lanka.

Keywords: Competency-Based Education; Traditional Methods of Education; Continuous Professional Development; Lesson Study.

Introduction

A well-informed and knowledgeable community is of vital importance for the economic and social development of modern society (Aturupane, Dissanayake, Jayawardene, & Shojo, 2011). Education builds up a well-informed and knowledgeable community that contributes positively towards the development of a country. Hence, it builds the skills, knowledge, attitudes, and behaviour required to perform real-world tasks or activities effectively. In this context, mathematics is vital in enhancing a person's analytical and problem-solving abilities. Competent students in mathematical literacy pave their way through higher studies and problem-solving in a dynamic and high-tech society (Aturupane et al., 2011).

Every child between the ages of five and fourteen should have access to free education provided by the government of Sri Lanka (Article No. 22 of the Constitution (1978;2000). The current structure of the education system in Sri Lanka has six steps (Nawastheen, 2019): Preschool education, Primary education, Junior Secondary education, Senior Secondary education, Collegiate Level, and Tertiary education. After completing the General Certificate of Education Ordinary Level (GCE O/L) examination at the end of the senior secondary level, which is considered a terminal examination, students have three paths to follow in their future: enter senior secondary education to gain access to tertiary education, enter a technical college to follow vocational training, and the rest, enter the world of work. Under the present education system, all these three groups follow the same curriculum till the end of grade 11 (Gunawardena, 2013). They study mother tongue, second language, math, science, history, and religion, and four other optional subjects as compulsory subjects. To continue studying at the General Certificate of Education Advanced Level (GCE A/L), a student should pass six subjects with a minimum of three passes for the compulsory subjects, which are mother tongue, math, and science. A pass for mathematics is mandatory to progress to the collegiate level in any stream. Even though Sri Lanka has taken many measures to increase the quality of mathematics education recently, mathematics continues to be the leading cause of the high dropout rate for the GCE O/L exam.

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Table 1: GCE O/L Examination 2019 Performance of Candidates (Mathematics)

Subject		Mathematics
Number Sat		304894
A	**Number**	58858
	%	19.3
B	**Number**	32685
	%	10.7
C	**Number**	69839
	%	22.91
S	**Number**	55329
	%	18.15
Passed(A+B+C+S)	**Number**	216711
	%	71.08
W	**Number**	88183
	%	28.9

(Source GCE O/L Examination 2019 Performance of Candidates, Research & Development Branch, Department of Examinations)

According to Table 1, in 2019, 28.92% of the student population who sat for GCE O/L mathematics obtained a 'W', which is a failure in mathematics. Only 71.08% qualified for the GCE A/L. Thus, this hindered their chance of entering the collegiate level and became school dropouts after GCE O/L. These dropouts have attended school but have yet to acquire the knowledge or skills to enter the world of work. Consequently, join the labour market without formal vocational training or employment skills that suit the needs of the ever-widening economy (Liyanage, 2013).

Figure 1 shows that the youth unemployment rate in Sri Lanka has risen to more than 25% from the year 2020 onwards. Recently, it revealed that highly qualified graduates had to wait long for employment through government recruitment schemes in Sri Lanka. Despite having highly skilled human resources, it has been observed that there is a continuous increase in unemployment and under-employment rates in the country (Grero, 2019). Subsequently, most graduates have the undesired choice of jobs due to the mismatch between their qualifications and the job market (Ariyawansa, 2013). Central Bank of Sri Lanka (2009) revealed that the prime issue is the need to bridge the mismatch between skills required through the education system and their qualifications and the labour market requirements.

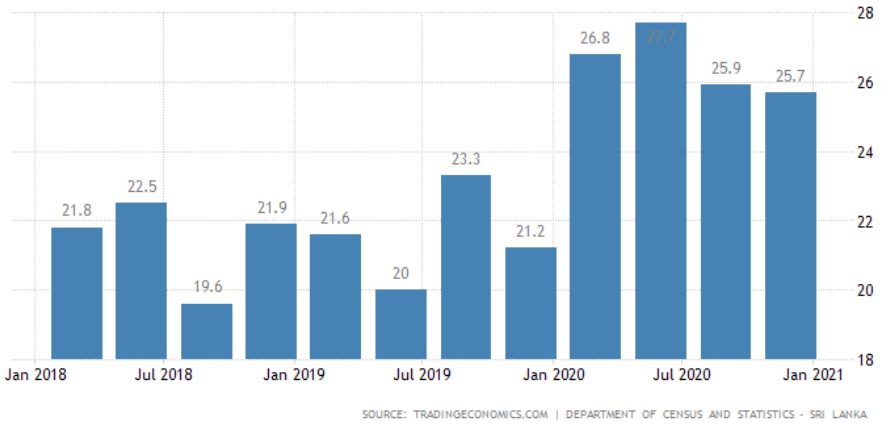

Figure 1: Youth Unemployment Rate in Sri Lanka (Source: Tradingeconomics.com | Department of Census and Statistics - Sri Lanka)

To provide a high-quality mathematics education system that caters to 21st-century skills, the government of Sri Lanka introduced a new competency-based curriculum at the national level in 2007. According to the National Council for Teachers of Mathematics (NCTM) (2015), the main aim was to produce a generation that can change what is known, explore the new, and build up new skills required for the future.

Although Sri Lanka has implemented a Competency-Based Education (CBE) system, it is yet to be determined to what extent this system is practised in the teaching-learning process of mathematics at the lower secondary level (Egodawatte, 2014). It needs to be discovered to what extent it has succeeded in providing equitable and quality education, ensuring quality learning and skills that are adequate for the changing world in the digitalisation and automation of industry. However, the present examination-centred education system in Sri Lanka, which is a teacher-centred system, has suppressed the progress and production of diverse and vibrant youth who can contribute to the country's development.

The present education system of the country must overcome three barriers to achieve its objectives: 1. the curriculum (Chandratilleke, Jayawardena, Mampitiya, & Widanapathirana, 2014), 2. the assessment (Egodawatte, 2014), and 3. the inadequate educational quality (Aturupane et al., 2011). Out of these three, inadequate quality of education mainly lies with the quality of teaching and educational leadership. It has been revealed that teachers with sufficient subject knowledge were in short supply and some taught subjects they were not qualified to teach (Aturupane et al., 2011). Teachers' professional development was mainly focused on content knowledge so that the exam pass rate would improve. Studies have shown that the knowledge received by the students is unsystematic and poor quality. Subsequently resulted in school dropouts due to boring lessons, teachers being negligent and abusive, and schooling becoming unattractive. Thus, teachers as potential change agents do not appear to have the required knowledge or sensitivity to issues such as human rights, social equity, gender equality, and national harmony that impinge on the issue of equal educational opportunity and education for all (Liyanage, 2013). This study aims to explore the level of preparation of middle school mathematics teachers to apply CBE in their teaching-learning process.

The following research questions were formulated to achieve the above aim.

1. What is the extent of pre-service professional development received by teachers in the application of CBE in their teaching-learning process?
2. What is the extent of in-service continuous professional development (CPD) teachers received in applying CBE in the teaching-learning process?
3. To what extent is a systematic, ongoing monitoring process provided for teachers?

The introduced CBE system in the teaching-learning process is commendable to be on par with the global standards in mathematics achievements. Improving the quality of the teaching and learning process in mathematics must be a key component in improving the quality of mathematics education. According to Aturupane et al. (2011) and Senevirathne et al. (2022), there is an urgent need for a comprehensive teacher development programme to enhance the knowledge and skills of mathematics teachers through teacher education and CPD). The current study's findings will give an insight into the training received by mathematics teachers and the extent to which they use the training in their teaching-learning process.

Theoretical Background

Teachers must be competitive in higher-order thinking and performance to facilitate young people with more complex analytical skills they need for the 21st century (Caena, 2011). To further develop the sophisticated teaching requirement for this mission, they must be offered more effective professional learning when needed. Teachers who go through professional development undertake a more comprehensive array of teaching practices and are more likely to cooperate with other teachers (OECD, 2009).

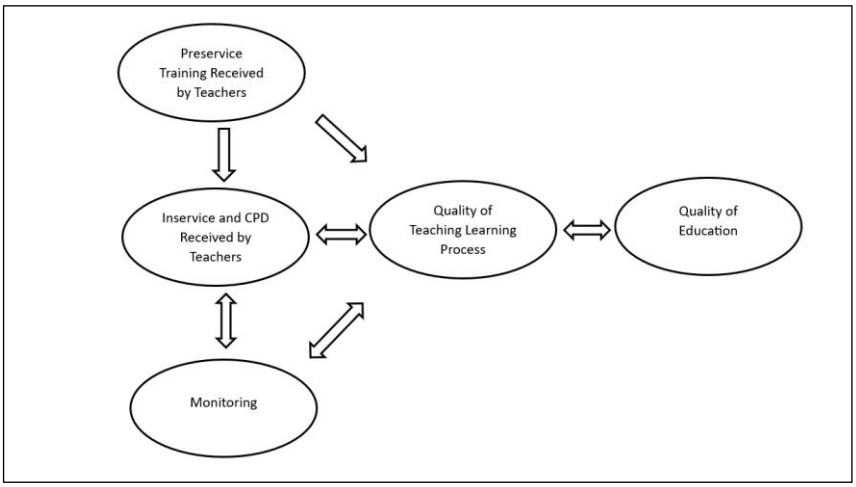

Figure 2: Conceptual Framework of the Study

Figure 2 gives the conceptual framework of the study. It indicates the relationship between pre-service training, monitoring of the teaching-learning process, and in-service CPD programmes. Thus, it affects the quality of the teaching-learning process and heightens the overall quality of mathematics education.

Literature Review

The literature review considers the definitions of competency and competency-based learning. Given the current research objectives, the studies related to pre-service professional development, lesson study

approach as an in-service continuous professional development, and systematic monitoring of the teaching-learning practices were reviewed.

1. Competence

Various authors have defined the concept of competency. According to the Department of Mines, Industry, Regulation and Safety of Western Australia (n.d), competency is the capability to apply or use the related knowledge, skills, and abilities required to successfully perform 'critical work functions or tasks in a defined work setting'. Giving a similar definition, Jallow (2011) states that competency is a statement of learning outcomes for a skill or body of knowledge. It further states that when students demonstrate competency, they demonstrate their ability to do something (showing the outcome of the learning process). According to Tambwe (2017), competency refers to an integrated set of skills, knowledge, and attitudes that enable one to effectively perform the activities of a given occupation or function to the standards expected at school and later in public, in the private sector, or for self-employment.

In this study, competency refers to a set of skills, knowledge, and attitudes that students need to have achieved to be successful in their school activities and, after that, in the world of work.

2. Competency-Based Learning

Competency-based learning refers to systems of instruction, assessment, grading, and academic reporting based on students demonstrating that they have learned the knowledge and skills they are expected to learn as they progress through their education (The Glossary of Education Reform, 2014). According to (Ali, et al., 2007), the concepts that underpin competence pedagogies have increasingly influenced the design of formal curricula. The competencies are structured around learning outcomes expected of learners rather than content to be covered. Also, it allows students to advance based on their ability to master a skill or competency at their own pace, regardless of the environment (Aschenbach, Janio, & Young, 2023). As a result, if students fail to achieve the expected learning standards, they receive additional instruction, practice time, and academic support to help them achieve the expected competencies or standards (The Glossary of Education Reform, 2014). Further, competency-based curricula are designed to produce lifelong learners with the flexibility to adapt to changing work environments due to the rapid development of technology.

3. Pre-service professional development received by teachers in applying CBE in their teaching-learning process.

According to Aturupane et al. (2011), teachers play a vital role in the education system. Teachers with sound mathematical knowledge and effective teaching practices are essential for imparting excellent mathematics education. It highlighted that the most crucial factors that contributed to the student's low achievement rate are the teachers' subject knowledge and the poor quality of training and monitoring provided for teachers. Thus, the students are passed from one grade to another without gaining the knowledge and skills essential to cope with the content in the higher grades. According to the study, approximately 2400 teachers without the required training teach mathematics in the secondary education cycle. The system has approximately 1600 Sinhala medium and 800 Tamil medium teachers with appointments for other subjects who teach mathematics in the secondary education cycle.

Further strengthening this, studies conducted by the National Institute of Education (NIE) and the Department of Education (DOE) reveal the urgent need for a comprehensive teacher development program to enhance the knowledge and skills of mathematics teachers. Although teachers are advised to use creative and real-world problems as activities in the teaching-learning process of mathematics, teachers mainly follow the activities specified in the teachers' guide in preparing the lesson plans. It is essential to ensure all mathematics teachers are subject-competent and have sound teaching practices since they play a pivotal role in providing students with high-quality mathematics education. Senevirathne, Wanigasekara, & Wijesundera (2022) investigated the mathematics teachers' classroom practices according to the five standards given in the NCTM, efficient classroom management, safe and stimulating learning climate, clear instructions, and adaption of teaching and learning strategies (NCTM, 2014). The results identified that all five need substantial improvement. Safe and stimulating learning climate, the adaption of teaching and learning strategies that facilitate the transfer of learning, metacognition, and interactive teaching and learning require special attention. A relative strength is having a clear structure with identifiable components in the lessons. Lack of attention to the whole class throughout the lesson, rare use of stimulating learning material, and limited opportunities for pair and group activities are areas for improvement affecting the sage and stimulating learning environment. The above weaknesses affect facilitating meaningful mathematical disclosure in the classroom teaching-learning process. Promotion of active learning that affects the development of students' reasoning, problem-solving, communication, and presentation skills and lack of attention to setting differentiated tasks to suit different ability levels of students and providing additional support for slow learners were the identified weaknesses of teachers. Transfer teacher behaviour to practice and promote the use of

stimulating teaching material, adapting them to the level and experience of students, tasks that promote higher order thinking rather than mere practice, cooperative learning, and group activities in the classroom, active learning, support slow-paced learners and more conversational and discussion forms of teaching need to be promoted. Improving teachers' mathematical knowledge and pedagogical practices through improved teacher education and CPD programs is urgently needed. The provincial teacher centres have made most teachers aware of the CBE process for continuing teacher education (Seneviratne, 2009). However, 40% had no idea of the basic features of CBE, and no one in the sample was fully aware of all the essential features in its real sense. In addition, it mentioned that most teachers need help identifying the specific learning outcomes under CBE. Also, teachers face difficulties organizing student-centred learning activities/ experiences under the CBE and providing learning opportunities in their disciplinary context, which focuses on discovery/exploration mode. In addition to these problems, 50% of the teachers need to be able to analyse these problems encountered in their classroom practices related to CBE. To overcome these barriers, the researcher suggests that the present teacher education institute should revisit their existing modes of curriculum dissemination, focusing on teachers' actual practices and the realities of many schools and students. It further highlights the need to revise their curriculum and instructional system to emerging needs, especially to empower the teachers with century workforce skills. After many years of implementing the CBE approach to mathematics, many teachers still need a clearer understanding of its expectations. Many teachers still teach to the test. Thus, the professional development of the teachers mainly targets the content knowledge, which improves grades. Teachers must be given comprehensive training on inquiry-based teaching integrating manipulatives and hybrid teaching-learning systems, allowing students to acquire 21st-century skills. It highlighted that all teachers should have an apparent understanding of the expectations of CBE.

4. In-service professional development received by teachers applying CBE in their teaching-learning process.

According to (Anfara Jr., Caskey, & Lenski, 2009), Lomibao (2016), and Burghes et al. (2010), the lesson study approach is a way for teachers to engage in professional development, leading to activities that promote instructional change. Also, it allows teachers to observe students while teaching a planned lesson. Teachers begin to see teaching from the student's point of view. Thus, the current study reviews studies on lesson study approaches as in-service CPD received by teachers.

The lesson study approach for teacher development is widely used in Japanese schools as a CPD process. Anfara et al. (2009) state that the lesson study approach is a method of professional development that encourages teachers to reflect on their teaching practice through a cyclical process of collaborative lesson planning, lesson observation, and examination of student learning. As teachers participate in lesson study groups, they actively discuss instructional interventions and share knowledge about how students will respond. Teachers then build on that collective wisdom as they watch each other teach and consider how best to engage students in learning. Thus, it helps to assess mathematics teachers' quality level and explore the use of lesson study to enhance their quality and promote teachers' professional development. Also, it determines the teacher's perception of using lesson study for the teachers' continuous professional development. Lesson study can be used as a form of CPD for teachers of primary, middle, and secondary (Lomibao, 2016). Teachers continuously enriched and upgraded their knowledge and skills in mathematics and mathematics teaching through the lesson study approach. They enrich educational experiences by affiliating with professional organizations and the community, promoting mathematics in and outside the school. It was strongly agreed that collaborative working is beneficial for them to become a better mathematics teacher. Since many teachers participate in the process, each teacher's experience will benefit the other teachers, making the lessons rich in sources and activities. Adding more to the findings of the above, Burghes & Robinson (2010) stated that an essential aspect of lesson study is that there must be some focus arising from the feedback sessions to take forward to the next lesson. Also, the cycle of planning, observing, and reviewing must build on one another to make progress rather than being stand-alone sessions. Lesson study sessions should be regular and ongoing, and feedback should be obtained from teachers and students to be effective.

5. Systematic Monitoring provided in the Teaching-Learning Process.

According to Aturupane et al. (2011), mathematics is taught in the classroom through various activities. All activities described in step-by-step detail follow the same format and prescribe the same teaching strategy. The activities are designed sequentially according to the learning cycle of engaging, Exploring, Explaining, elaborating, and Evaluating (5E). It further stated that the teachers use only the activities specified in the TIMs in their lessons and need more flexibility to develop their lessons or use different teaching strategies. There needs to be systematic monitoring to identify these shortcomings in the teaching-learning process. Teachers should be encouraged to prepare their

lesson plans with creativity and horizontal integration of subjects. The use of modern technology in the teaching-learning process to help students acquire 21st-century skills to meet the demands of the world of work is of utmost importance. An ongoing monitoring program needs to be designed and implemented to ascertain whether the objectives of the curriculum are met, and training provided wherever necessary. The teacher development programs conducted by the NIE should be improved and liaise with university academic staff involved in curriculum development and teacher education to create a meaningful teacher development program.

Further strengthening the need for monitoring, Bandula Gunawardane, Minister of Education (Ministry of Education, 2014), stated, "Evaluation is an indispensable factor to monitor an organization, to see if that particular entity reaches the expected objectives and make necessary alterations and modifications when required. Thus, an education management system targeting quality development of the school system is mandatory". He further emphasized that a robust and continuous evaluation methodology, which focuses on the achievements of high-quality education, is essential to fulfilling the objectives. Considering the above objectives, the authorities have conducted school team inspections since 1950. Documents and reports maintained in schools were checked, and teacher observations were done by the relevant officers (Ministry of Education, 2014). In the 1980s, Sri Lanka focused on a 'bottom up' administration process instead of a 'top down' one. The schools were directed towards a self-evaluation methodology, which was done mainly within the school while having an external supervision system to support schools as required. In the 1990s, more emphasis was placed on self-evaluation than external supervision. In 2015, a new traditional school education was introduced. All schools are expected to develop a robust self-evaluation methodology using evaluation criteria, indicators, and new standards. The learning, teaching, and assessment were evaluated under three criteria: Planning and approach to the lesson, high-quality lesson development, assessment, and exhibiting individual responsibilities and personality. These criteria were measured using several indicators under each criterion. When analysing the indicators, they are to analyse the teaching-learning process in general. However, there needed to be indicators to analyse specific competency-based education systems prevailing in the country. The indicators do not analyse the students' ability to use higher-order skills and to improve the skills necessary for the world of work.
Poor quality of pre-service training and the inadequate subject knowledge of the teachers have paved the way for students to move ahead without gaining the required knowledge and skills in mathematics. Irrespective of the instructions for using creative real-world situations in the teaching-learning process, teachers continue to use the textbook and teacher guide. Though the teachers have undergone pre-service professional development, they continue encountering problems applying CBE approaches in teaching-learning. There needs to be a proper mechanism to monitor the teaching-learning process and identify the drawbacks in implementing CBE concepts to provide necessary in-service training when required. The lesson study concept is an ideal way for in-service continuous professional development. It encourages teachers to engage in collective lesson planning, lesson observation, and planning assessment processes. Since many teachers participate in this process, each teacher's experience will benefit the other teachers in applying CBE concepts in their teaching-learning process.

Methodology

1. Research Design

The current study employs quantitative survey research that consists of a well-structured survey questionnaire.

2. Population and Sample

The population of this research study was the lower secondary school teachers of mathematics from national schools in Sri Lanka. Although it intended to select the sample from all nine provinces of Sri Lanka, the government schools were closed for a long time due to the economic crisis and political instability. The private schools were conducting lessons through online platforms. Due to the time constraint, the sample selection was limited to the Western Province, which consists of three districts: Colombo, Gampaha, and Kalutara.

The schools in Sri Lanka are categorised into four main groups, 1AB, 1C, Type 2, and Type 3 schools. 1AB schools: schools with GCE A/L classes with science stream; 1C schools are schools with GCE A/L classes other than Science stream; Type 2: schools with classes up to GCE O/L, and Type 3 schools are elementary schools with classes up to grade 8. The research sample was selected from 1AB, 1C, and Type 2 schools. Western Province was selected because it has the most significant number of government schools by functional grade and the most populated schools.

A sample consisted of 276 mathematics teachers. Purposive sampling, one of the non-random sampling methods, was used to recruit the study participants.

Table 2: Sample Selection for the Study

District	1AB	1C	Type 2
Colombo	58	40	7
Gampaha	40	52	9
Kalutara	30	32	8
Total	128	124	24

Table 2 above shows the sample selection of 276 teachers chosen randomly from the three districts according to 1AB, 1C, and Type 2 schools. The researcher obtained prior permission from The Ministry of Education and The Department of Education (Western Province) to research the selected schools.

3. Instruments

A survey questionnaire formulated based on the attributes of previously done studies adapted to the Sri Lankan context was the main instrument of the study. It consisted of four sections. Participants were instructed to indicate their level of agreement according to a Likert scale from strongly agree to strongly disagree. A pilot test was carried out with 15 mathematics teachers in the Western Province.

4. Procedure and Data Collection

276 teachers participated in the study from the three districts in the Western Province. Data was collected by the researcher personally visiting the schools and through a Google form.

Data Analysis

The quantitative data were tabulated and statistically analysed using IBM SPSS Statistical Analysis version 28 using descriptive analysis like percentages, mean, and standard deviation.

1. The Findings

The demographic information of the research participants collected through part A of the survey questionnaire is given in Table 4. In the quantitative data analysis, the teachers in the sample were grouped according to age, gender, experience, educational qualifications, primary subject in the bachelor's degree, number of periods worked for a week, and the number of students in the class.

Table 3: Profile of the Teacher Sample

Teacher Characteristics	Categories	Frequency	Percentage (%)
Age	20 – 30	12	4.3
	31 – 40	84	30.4
	41 – 50	120	43.5
	50 or more	60	21.7
	Total	276	100
Gender	Male	78	28.3
	Female	198	71.7
	Total	276	100
Experience	0 - 10	90	32.6
	11 -20	114	41.3
	21 - 25	18	6.5
	26 or more	54	19.6
	Total	276	100
Educational Qualifications	Trained	66	23.9
	Graduate	126	45.7
	Post Graduate Diploma	78	28.3
	Masters	6	2.2
	Total	276	100
Primary Subject in the Batchelor's Degree	Maths	174	63
	Chemistry	12	4.3
	Other	90	32.6

	Total	276	100
Number of Periods Teach for a Week	16 -20	18	6.5
	21 - 30	108	39.1
	More than 30	150	54.3
	Total	276	100
Number of Students in the Class	11- 20	18	6.5
	21- 30	102	37
	31 - 40	48	17.4
	41 - 50	108	39.1
	Total	276	100

According to Table 3, out of the 276 participants, 4.3% of the teachers are between 20 to 30 years of age, and 65.2% of the teachers are above 40 years of age. 28.3% of the participants are male, whereas 71.7% are female. 32.6% have less than 10 years of experience, whereas 26.1% have more than 20 years of experience as a teacher. 76.2% of the teachers are graduates or more qualified and 23.9% of the teachers are only trained teachers. 63% of the mathematics teachers have done mathematics as their primary subject in their bachelor's degree, but 36.9% of teachers have not done mathematics as a subject in their higher studies. 54.3% of the teachers work more than 30 periods a week. Only 6.5% of the teachers work between 16 to 20 periods of work within a week. The mean number of periods a teacher works for a week is 29.78. When considering the number of students in the class, 39.1% of the teachers have stated that they teach classes with 41 to 50 students. 17.4% of the teachers have stated that they teach classes with a student population of 31 to 40 students. Only 43.5% of the teachers have stated that they teach classes with a student population of less than 30 in a class. The mean number of students in a class is 33.91.

The analysis of the level of preparation teachers have received in the application of CBE in the teaching-learning process of mathematics was done under three themes: pre-service professional development received by teachers in the application of CBE in their teaching-learning process, in-service CPD received by teachers in the application of CBE in the teaching-learning process and Systematic monitoring provided by the authorities in the teaching-learning process.

2. Pre-service Professional Development Received by Teachers in the Application of CBE in their Teaching Learning Process

The pre-service professional development received by the teachers was analysed using seven indicators.

Table 4: Responses for Pre-service Professional Development Received by Teachers in the Application of CBE in their Teaching Learning Process

Indicators	Strongly Agree	Agree	Disagree	Strongly Disagree	Total
Taken part in seminars and training on different mathematics teaching strategies.	37%	50%	13%	-	100%
Trained to identify real-world problem-solving activities for the teaching-learning process.	30.40%	43.50%	23.90%	2.20%	100%
Trained to focus on how learners can be helped to achieve their intended mathematics learning outcomes.	23.90%	56.50%	19.60%	-	100%
Trained to be an expert, dedicated, and committed to planning, developing, and improving the mathematics curriculum to achieve success in the learners.	21.70%	54.30%	23.90%	-	100%
Know how to do action research if encountering a problem in the teaching-learning process.	6.50%	63%	28.30%	2.20%	100%
The training received is sufficient to conduct the teaching-learning process of mathematics.	13.00%	56.50%	30.50%	-	100%
The training is used in the teaching-learning process	19.60%	54.30%	26.10%	-	100%

The pre-service professional development in the application of CBE in the teaching-learning process of mathematics was analysed using the indicators given in Table 4. 87% of the participants have taken part in seminars and training programs on different teaching strategies for mathematics. Though 87% have received training, only 73.9% of the participants use the training they received in their teaching-learning process. 73.9% of the participants have received training to identify real-world problem-solving activities in their teaching-learning process, and 80.4% have received training focusing on how learners can be helped to achieve their intended mathematics learning outcomes. 76% of participants who received the training are trained to be experts, dedicated, and committed to planning, developing, and improving the mathematics curriculum to achieve the learner's success where necessary. Only 69.5% of the participants knew how to conduct action research when encountering a problem in their teaching-learning process, whereas 30.5% did not know what action research is.

3. In-Service CPD Received by Teachers in the Application of CBE in the Teaching Learning Process

The use of the lesson study approach as in-service continuous professional development to enhance the application of the CBE teaching-learning process by mathematics teachers was done by analysing five indicators.

Table 5: Responses for In-Service CPD Received by Teachers in the Application of CBE in the Teaching Learning Process

Indicators	Always	Sometimes	Rarely	Never	Total
Work with other math teachers in small groups to discuss learning goals.	4.50%	76%	19.50%	-	100%
Collaborate with a small group of math teachers in planning actual classroom lessons.	23.90%	50%	26%	-	100%
Observe how other teachers' ideas work in a live lesson with students.	4.30%	50%	43.50%	2.20%	100%
Discuss the observations of the live lesson with a group of teachers.	4.30%	47.80%	45.70%	2.20%	100%
Discuss other teachers' experiences in real-life situations and use them in lessons where necessary.	6.50%	50%	43.50%	-	100%

According to Table 5, 80.5% of the teachers have mentioned discussing learning goals with a small group of teachers. However, 19.5% have stated that they do not discuss their learning goals with other teachers. 73.9% of the participants mentioned collaborating with a small group of math teachers in planning actual classroom lessons, and 26% did not discuss their lessons with other teachers. 54.3% of the participants observe how other teachers' ideas work in a live lesson with a group of students. Whereas 46.7% do not observe the lessons of other teachers. 52.1% discuss their observations with teachers after observing a lesson. 47.9% do not discuss the outcomes of the lesson observation with peers. 56.5% of the teachers discuss with other teachers to identify real-life situations to plan their teaching-learning activities, whereas 43.5% disagree with discussing with peers in identifying real-life situations when planning activities.

4. Systematic Monitoring Provided by the Authorities in the Teaching-Learning Process.

Systematic monitoring provided for the teachers by their authorities is analysed using five indicators. Responses are given in Table 6. 50% of the participants stated that their school authorities constantly monitored their classroom teaching, and 44.6% were provided with feedback on their teaching-learning process. 47.8% were given training when required as carrier-building programs. Thus, 47.8% of the teachers agree that their training was beneficial in uplifting their teaching-learning process. 56.5% of the participants feel free to discuss any problem related to the teaching-learning process with their school's administrators, whereas 43.5% do not feel free to discuss it with their authorities.

Table 6: Responses for Systematic Monitoring Provided by the Authorities in the Teaching Process

Indicators	Always	Sometimes	Rarely	Never	Total
Constant monitoring is done through the mathematics lesson by the administrators	6.50%	43.50%	47.80%	1.00%	98.80%
School administrators provide feedback on the teaching-learning process after observing	4.30%	41.30%	54.30%	-	100%
Authorities provide training when the need arises	4.30%	43.50%	52.20%	-	100%
The ongoing training provided by authorities is instrumental in career development	4.30%	43.50%	52.20%	-	100%
Free to discuss any problem related to the teaching-learning process with the school administrators.	21.70%	34.80%	43.50%	-	100%

Discussion

The study aimed to identify teachers' readiness to apply the CBE approach in the teaching-learning process of mathematics at the lower secondary level in Sri Lanka. The data was collected under three specific objectives: Pre-service professional development received by teachers, in-service continuous professional development received by teachers, and systematic monitoring provided in the teaching-learning process. The results indicate the need for sufficient training to practice the CBE approach in their teaching-learning process effectively. Teachers must be fully aware of the different approaches, like group study methods and action research, to enhance their teaching-learning process. Due to inadequate monitoring and support given to teachers by the authorities, the CBE approach is not practised sufficiently in the classroom teaching-learning process. This is further enhanced by the high number of students in a classroom and the number of periods taught by a teacher in a week.

The findings are aligned with the findings of Seneviratne (2009). The teacher is pivotal as a facilitator in the competency-based teaching-learning process. Hence, the teacher should be thoroughly equipped with the required knowledge and competency for the role in the teaching-learning process. According to Seneviratne (2009), even though the teachers have received the initial training on applying CBE in their teaching-learning process, they still need to be monitored and given adequate continuous training to update themselves to continue the approach successfully. There are several areas for improvement in the training given to teachers. The teachers must be fully equipped with different methods of enhancing their teaching-learning process (Seneviratne, 2009). According to the current study, 2.2% of the teachers have never observed how other teachers' ideas work in a live lesson with a group of students nor discussed other teachers' experiences in real-life situations and used them in lessons where necessary. Only 73.9% of the teachers always and sometimes collaborate with a small group of math teachers in planning actual classroom lessons. Further, the ability to think analytically when teachers encounter a problem in the CBE teaching-learning process is comparatively low in teachers (Seneviratne, 2009).

According to Aturupane et al. (2011), many teachers in the system need the required mathematics training; initiating a comprehensive teacher development program is vital to provide teachers with the required subject knowledge and training in good teaching practice. Further emphasising the requirement, the current study's results indicate a disparity in appointing teachers to teach mathematics as a subject. Almost ¼ of the teacher sample are not graduates; 36.9% are not qualified to teach mathematics at the lower secondary level. This group of teachers has not done mathematics as a subject in their bachelor's degree. They teach mathematics without the basic knowledge of the subject.

Continuous monitoring of the application of the CBE approach in the teaching-learning process needs to be more robust in schools. This directly influenced teachers to move away from the competency-based approach. This was further encouraged by the high number of periods teachers worked for a week, with a mean value of 29.78, and the very high number of students in a class, with a mean value of 33.91. The teachers need help to allocate time to prepare proper lesson plans with real-life situations due to the high amount of teaching time for a week. They were also carrying out activities and group work, which builds up skills, too much work due to the high number of students in the class. Therefore, it highlighted that the teachers practice a mixed method of competency-based approach and traditional methods. Due to

various reasons, authorities still need to continue teacher monitoring in various instances and to identify where training is necessary (Aturupane et al., 2011).

Another significant observation was that 23% of the teachers are only trained teachers, and most are in their mid-career and late carrier stages of the professional life cycle model proposed by Huberman (1989). Thus, this group of teachers needs to be motivated to engage in continuing professional development, which is a primary barrier to maintaining uniformity and quality of delivery.

Conclusion

The study, The Application of the CBE in Secondary School Mathematics Education in Sri Lanka, mainly explores the level of preparation that the teachers received on the application of CBE in the teaching-learning process of mathematics. This is done using three research questions: What is the extent of pre-service professional development received by teachers in the application of CBE in their teaching-learning process? What is the extent of in-service CPD teachers received in applying CBE in the teaching-learning process? To what extent is a systematic, ongoing monitoring process provided for teachers? The researcher adopted a quantitative method, and data collection was through a questionnaire administered to 276 teachers in the Western Province. The results indicate that teacher training and monitoring should be more efficient in the teaching-learning process of mathematics.

A sample of 276 lower-secondary mathematics teachers from the Western Province of Sri Lanka participated in the study. Thus, the findings could be affected by the spread of teachers and limitations of the data collection instruments used by the researcher. In the current study, the data collection instrument is not geared to collect in-depth information as to the preparation of teachers to apply CBE in their teaching-learning process. The current study adopted a quantitative approach to analyse the teachers' readiness. A mixed method using data triangulation may be more helpful in enriching, elaborating on, and analysing candidate preparation and program improvement efforts (Beverly, Catherine, & Stephen, 2011). Also, the study collected data from one private school in Colombo District due to the challenges faced by the researcher to get approval from various schools. Therefore, collecting data from various government and private schools is recommended in future studies.

An urgent need for a comprehensive teacher development program to enhance the knowledge and skills of mathematics teachers is of vital importance. It is strongly proposed that every teacher in the country undergo a strong awareness program to prepare them to practice competency-based education in their teaching-learning process of mathematics. Establishing a mechanism for teachers to engage in a professionally realistic period for teaching in keeping with international standards is recommended. Also, authorities should allocate a particular period for professional development activities, which will be rewarded periodically. Finally, a robust monitoring and evaluation regular mechanism and routine is recommended to continue CBE teaching practices.

Conflict of Interest

The author declares no conflict of interest in the conduct of this research.

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