

## Fostering Digital Education among Teachers and Learners in Sri Lankan Schools

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**Abstract:** The Commonwealth Digital Education Leadership Training in Action (C-DELTA) programme provides a framework for fostering digital education for lifelong learning by developing digital education leaders. The Faculty of Education at the Open University of Sri Lanka implemented an action research project to promote the adoption of C-DELTA among teachers and students of secondary schools in Sri Lanka, and evaluate its impact on the teaching-learning process. A group of 41 teachers participated in the intervention and implemented C-DELTA in their schools. A variety of data were collected throughout the process via questionnaires, concept maps, focus group interviews, implementation reports, and log records in the C-DELTA platform. Findings revealed that despite challenges, such as inadequate ICT facilities, time constraints and limitation in English language competencies, the adoption of C-DELTA has supported improving digital literacy, enacting changes in thinking and digital behaviour among teachers and students, and enhancing teachers' digital education leadership skills.

**Keywords:** C-DELTA, digital education, digital education leadership, digital learning.

### Introduction

Digital technologies are increasingly changing our daily life practices. Digital skills are inevitable for individuals in the present age of digitalization in order to accommodate rapidly developing digital demands. Thus, fostering digital education has become an essential need in the current era. The Commonwealth Digital Education Leadership Training in Action (C-DELTA) programme of the Commonwealth of Learning (COL) provides a framework for fostering digital education and developing skilled citizens for lifelong learning (see <https://cdelta.col.org/>). It provides an avenue to develop digital competencies of individuals through an online learning platform which provides access to seven modules related to digital education. The curriculum and learning modules of C-DELTA were developed by the University of Cape Town (UCT), South Africa, in partnership with COL, in 2016 (see <http://oasis.col.org/handle/11599/2442>). Through the C-DELTA programme, individual learners can develop their digital skills by engaging in self-study using these online resources and be certified online.

In 2018, the Faculty of Education of the Open University of Sri Lanka (OUSL), with the support from COL, implemented a research project to promote the adoption of the C-DELTA programme by teachers and students of the secondary school level in Sri Lanka. The key intention of the project was to promote digital education environments and develop capacity among school teachers on the implementation of C-DELTA in the teaching-learning process. This paper reports on the study conducted to explore how, and in which ways, the adoption of C-DELTA had an impact on the teaching-learning process in the secondary school level in Sri Lanka.



## Review of the Literature

In the global knowledge society of the 21st Century, the development of digital literacy is inevitable. It will promote individuals' ability to search for, retrieve and manage information efficiently, and to work collaboratively. Digital competence is the confident, critical and responsible use of, and engagement with, digital technologies for learning, work, and for participation in society (European Commission, 2019), which allows rapid access to, and effective use of, information. Self-directed learning of students is enhanced by digital technologies, due to their flexibility in managing time, space and pace of learning (Baporikar, 2018). Digital competence will also improve lifelong learning opportunities for all (UNESCO, 2014).

Today's children, who are "digital-age learners" (Collier, Burkholder & Branum, 2013), readily engage with numerous innovative digital devices with ease. Their enhanced knowledge and skills in the use of digital technologies should be positively applied for academic purposes, which requires changes in conventional educational thinking and practices. In this context, contemporary teachers have a significant role to play as 'change-enablers', using digital tools productively in education (Srivastava & Dey, 2018), and enhancing digital literacy among learners.

Digital literacy involves capabilities needed by individuals for living, learning and working in a digital society (JISC, 2015). Individual capabilities in different dimensions of digital literacy may vary within the same digital practice (McGill et al, 2017). Further, digital literacy is an ongoing and dynamic process which may change depending on the situation (Martin, 2008). Hence, developing appropriate "digital literacy practices" (Beetham, McGill & Littlejohn, 2009) among learners becomes essential. A pyramid model of Digital Literacy Development (Sharpe & Beetham, 2010) illustrates how a learner's awareness of, and access to, digital technologies (*I have*) leads to skill development (*I can*), which in turn leads to application of skills or practices (*I do*), resulting in the formation of an individual's "digital identity" (*I am*). It indicates how a learner's experiences and practices contribute to the formation of his/her digital identity, and how the learner's identity informs his/her digital practices. This suggests some key aspects to consider when planning digital education programmes.

Digitalization of education involves the use of digital technology, to improve processes and products, which depends on various aspects such as organizational support, technological infrastructure and pedagogical approaches (Bates, 2015; Selwyn, 2016). With the integration of digital technology, notable changes are taking place in classroom teaching and learning, where teachers' roles need to significantly transform (Srivastava & Dey, 2018). Teachers require development of specific competencies to be able to support active knowledge construction of students in digital learning environments (Kaur, 2016). Despite increased technology integration in the classroom teaching-learning process, it is often questionable whether the learners are being equipped with the expected 21st century learning skills, due to the sustained traditional teaching-learning practices in the educational institutions (Phillips, 2015).

The availability of novel technology in the digital era demands improving the performances of all stakeholders in education (Srivastava & Dey, 2018) who could become digital leaders. A digital leader is a person who is willing to take leadership in using the technology in order to enhance organizational output (Briggs, 2017; Rouse, 2007). Digital education leaders will demonstrate effective use of digital technology for teaching, and advocate, influence and build the capacity of others. With

the growing significance of digital education needs, leadership development in digital education has also become an urgent need (Lynch, 2018, McLeod, 2015; Mishra et al, 2016; Sheninger, 2014).

Digital leadership is a skill within a person who understands the digital tools, practices and ability in using digital knowledge by bridging the gaps within an organization and leading the organization in achieving its goals (Fisk, 2002; Gorton, 2018). Digital leadership is also establishing direction, influencing others, and initiating sustainable change through the access of information, and establishing relationships, requiring a dynamic combination of mindset, behaviours, and skills to change a school culture (Sheninger, 2014). Such digital leadership qualities need to be developed in a systematic manner. Leadership in schools is perceived as a collaborative team effort where teachers become leaders in the classroom (Bennet, 2008). Digital Education Leadership is an important characteristic to be developed in teachers to guide and help their students become more informed and critical digital citizens in the future.

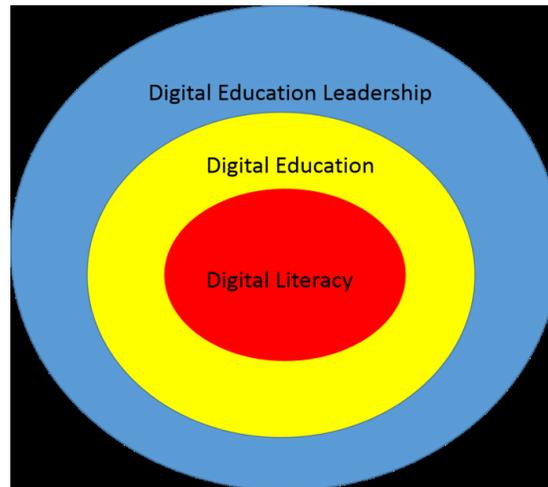
Various models and frameworks that have been presented in relation to e-learning and leadership in e-learning, educational technology, and digital education provide some useful insights. For instance, the People-Process-Product or the P3 model (Khan, 2015) emphasizes that in e-learning, *people* are involved in the *process* of creating e-learning materials, or *products* and making them available to its target audience. Jameson (2013) presented a leadership framework comprising purpose, people, structures and social systems, targeting development of e-leadership in higher education. The “Digital Practitioner Framework” (Bennett, 2014) provides a comprehensive perspective on how digital education leadership competencies can be developed in terms of access, skills, practices and attributes. Introducing seven pillars of digital leadership, Sheninger (2014) stresses that digital leadership is not just about tools, but involves a strategic mindset to bring about “change”.

To facilitate such “change”, teachers need to be professionally developed in line with the objectives of digital education (Srivastava & Dey, 2018). Recognizing the need to develop leadership in this area, several policy level decisions have been made within the Sri Lankan context (Ministry of Education, Sri Lanka, 2011). While various e-learning initiatives have taken place in Sri Lanka in recent history, there is a need to bridge the internal digital and social gap that exists (Mozelius, Hewagamage & Hanson, 2011). Also, to reduce the complexity of e-learning as perceived by actual and potential users of e-learning facilities in Sri Lanka, development of more user-friendly techniques and e-learning environments, where potential benefits are clearly visible, are needed (Yatigammana, Johar & Gunawardena, 2013). Intending to increase educational opportunities throughout the country, use of e-learning, online course delivery, and innovative educational technologies have been expanded in the higher education institutions in Sri Lanka (Dona & Warusavithana, 2014).

Numerous initiatives have been launched to expand the facilities needed to enhance digital learning within the Sri Lankan school system. As a result, many schools are equipped with computer laboratories, Internet and Wi-Fi facilities, software packages and e-learning resources. The subject Information Technology has been introduced to schools to enhance digital literacy among learners (Ministry of Education, Sri Lanka, 2011). Further, the importance and need of training teachers in digital education has been identified (Ministry of Education, Sri Lanka, 2012). The C-DELTA project implemented by the OUSL focused on developing capacity among secondary school teachers to become digital education leaders in their own school communities.

## Conceptual Framework

A holistic approach to digital education leadership is conceptualised in the C-DELTA Programme. It presents the argument that digital education leadership is grounded in the practice that it seeks to foster — i.e., digital literacy practice — and the processes involved in teaching that practice — i.e., digital education (Brown et al, 2016) (see Figure 1).



**Figure 1: A holistic view of digital education leadership.**

(Source: Brown et al, 2016, p. 10,  
<http://oasis.col.org/handle/11599/2442> (CC BY-SA))

According to this holistic view, digital literacy as a social practice is the core, which is the outcome, or the destination, of digital education and digital education leadership. It is also the purpose of digital education. Digital education is the pedagogic intervention that will drive the fostering of digital literacy among individuals. Digital education leadership is about providing direction to achieve the learning goal of digital literacy, in terms of digital education through enhancing access, building capacity in peers, making informed decisions and cultivating innovation (Brown et al, 2016).

Within the C-DELTA programme, digital education is described as a process of teaching and learning involved in fostering the capabilities that are needed for an individual to live, learn and work in an evolving digitally-mediated society. This view emphasises enhancing capacity building in context-based digital literacy practices, specifying a need for digital education leaders who can take leadership in fostering digital literacies relevant to their contexts. Such leaders can foster digital literacies through several means, such as creating awareness of and enhancing access to available resources, developing capacity in individuals, curricula and organisations, making informed decisions, and cultivating innovation. Thus, they will be change agents in their own contexts (Brown et al, 2016).

The planning and implementation of the current study was grounded in the above conceptual framework of the C-DELTA programme.

## **Methodology**

### **Research Design**

This study adopted an action research approach. Action research is a form of self-reflective inquiry undertaken by participants in social situations to improve their practices, which is a systematic and an iterative process comprising four stages: planning, acting, observing and reflecting (Carr & Kemmis, 1986; Masters, 1995). This approach takes a collaborative approach, where educators work together with participants to improve their practices by empowering relationships and developing reflection about teaching (Bryant, 1995). Such collaborative action research will lead to improvement of educational practices by change, through a dynamic intervention process.

The research team engaged in a systematic process of activities comprising the design and implementation of an intervention programme for participant teachers to promote the adoption of the C-DELTA programme in their schools and evaluate its impact on the teaching-learning process. In turn, the participant teachers themselves engaged in small-scale action research investigations in their schools, on the implementation of the C-DELTA project and its effects. Teachers who employ action research in such an investigative approach will be motivated to self-assess and reflect on their actions to enhance their teaching. In the context of this project, the action research approach provided an appropriate and a convenient methodological framework, to change and improve educational practices in real-life situations of practitioners.

### **Aim and Objectives**

The main aim of the study was, to promote the adoption of C-DELTA by teachers and students of secondary schools in Sri Lanka and evaluate its impact. The following specific objectives were formulated in line with this aim:

1. To review the existing level of digital education practices among the participant school teachers.
2. To design an intervention programme to promote the adoption and implementation of the C-DELTA programme in secondary schools.
3. To implement the intervention programme comprising capacity development of teachers and facilitating the adoption of C-DELTA in their schools.
4. To evaluate the impact of the implementation of C-DELTA on the teaching-learning process.

### **Participants**

Participants of the study were purposively selected from among the school teachers who were students of the Postgraduate Diploma in Education Programme of the Faculty of Education, OUSL, considering the following factors:

- Representing all nine provinces of the country
- Representing different mediums of teaching (Sinhala/Tamil)
- Representing male/female participants
- Teaching either ICT, Mathematics or Science at secondary school level
- Having basic ICT skills and teaching in a school with an ICT laboratory.

The selected participants comprised 41 graduate teachers, from 39 schools. Table 1 indicates the participant teacher details.

**Table 1: Details of the Participant Teachers**

Province	No. of Teachers	Medium of Teaching		Gender	
		<i>Sinhala</i>	<i>Tamil</i>	<i>Male</i>	<i>Female</i>
Central	03	02	01	01	02
Eastern	04	00	04	04	00
Northern	03	00	03	02	01
North Central	02	02	00	02	00
North Western	04	04	00	01	03
Sabaragamuwa	02	02	00	00	02
Southern	02	02	00	01	01
Uva	04	01	03	03	01
Western	17	14	03	03	14
Total	41	27	14	17	24
<b>Percentage</b>	<b>100%</b>	<b>65.9</b>	<b>34.1</b>	<b>41.5</b>	<b>58.5</b>

### The Intervention Process

The intervention process was conducted in several steps according to the four stages of the action research cycle – Plan, Act, Observe and Reflect (see Table 2).

**Table 2: Key Activities Conducted During the Intervention Process**

Stage	Activities	Data Collection Strategies
Plan	1. Reviewing the existing levels of digital education practices among the participant school teachers	Pre-intervention questionnaire
	2. Design of an intervention including different strategies and tools to promote the adoption of C-DELTA programme in the secondary schools.	
Act	3. Implementation of the intervention through a capacity development process of the participant teachers	Concept mapping Questionnaire survey Self-reflections
Observe	4. Monitor and facilitate the implementation of interventions in the schools (Online monitoring, School observation visits)	Logs in the C-DELTA platform Checklists Focus group interviews Teachers' Interim reports
Reflect	5. Ascertaining impacts of the intervention through participant teachers' reflections (Evaluation Workshops, Writing Workshops)	Teachers' Final reports Reflective narratives
	6. Open sharing of teacher experiences and reflections as a basis to promote further interventions	Website of sharing teacher reflections on their experiences as "stories"

### *Planning the Intervention*

A preliminary questionnaire was administered among the school teachers prior to the intervention. This survey revealed the participant teachers' demographics and their existing levels of ICT practice. Accordingly, it was observed that the teachers possessed adequate ICT skills, 40% stating "Excellent" and 60% stating "Average", and that all of them were integrating ICT in their teaching-learning process. Further, 80% of the teachers claimed having an "Average" level, and only 20% having an "Excellent" level of English language proficiency.

The teachers' stated main expectations in participating in the C-DELTA project were to improve their ICT skills and leadership skills, to develop digital education skills among their peer teachers and students, and to share new knowledge in their schools. Several challenges anticipated were time constraints, lack of enthusiasm by the other teachers, limited ICT and English language skills of the students, and inadequacies in the computer and Internet facilities in their schools. This preliminary analysis indicated that the participants were still well-prepared to proceed with C-DELTA implementation, despite the expected challenges.

Based on the findings of the preliminary survey, an intervention was designed including different strategies to further develop capacity of the participant teachers and to introduce, promote and facilitate the adoption of C-DELTA in their schools (see Table 2).

The intervention commenced with an initial three-day "Training of Trainers" (ToT) workshop held in July 2018. This included registration of teachers in the C-DELTA platform, followed by a series of hands-on sessions with activities including interactive discussions, presentations, concept mapping and learning object creation. These activities helped the participant teachers to understand the key concepts underpinning the C-DELTA curriculum, to share ideas through collaborative activities, to understand their leadership role as C-DELTA coordinators/managers and to prepare individual implementation plans to conduct C-DELTA in their own schools.

### *Implementing and Monitoring the Intervention*

The planned activities were implemented in the schools from August 2018 to February 2019. Initially, the participating/coordinating teachers mainly became familiar with the C-DELTA platform themselves by studying the modules and completing the activities. Next, they implemented their action plans as mini-interventions in their respective schools, comprising the following activities:

- Conducting an orientation session for the secondary level students and teachers in order to make them aware of the C-DELTA platform.
- Encouraging students and teachers to register and take up the C-DELTA modules online over a period of six months.
- Providing support and guidance as required to those who took up the modules of C-DELTA.
- Designing and developing learning activities to improve digital literacy among students.
- Monitoring, gathering data, evaluating and reflecting upon their implementation process.

While these activities were ongoing in schools, the research team engaged in constant monitoring of teachers' and students' online engagement in the C-DELTA platform via logs, and communicating with the coordinating teachers to motivate and provide feedback to overcome various challenges faced by them. During the intervention process, observation visits were conducted in nine selected

schools, which allowed the research team to monitor and identify good practices and to further support promoting C-DELTA among the school community.

### *Reflecting on and Evaluating the Impacts of the Intervention*

The impacts of the intervention were identified through the variety of data collected during the process. Mainly, the coordinating teachers’ self-reflections, interim reports and final reports, as well as the focus group discussions and observations during the school visits, revealed the impacts. However, out of the 41 coordinating teachers, only 21 teachers participated in the final evaluation workshops and submitted their final reports.

## **Analysis, Findings and Discussion**

A comprehensive approach was employed to collect the data throughout the process using multiple data gathering strategies, comprising questionnaire surveys, concept mapping, semi-structured interviews, focus group discussions, observations, log records in the C-DELTA platform, teachers’ reflections, interim reports and final evaluation reports. Quantitative methods, such as descriptive statistics, and qualitative methods, such as content analysis, were used to analyse the data.

### **Perceptions and Perspectives on Digital Education**

The participant teachers’ overall reaction to the initial ToT workshop was very positive. They indicated it was quite helpful in developing their digital education leadership skills in different aspects and developing their confidence to promote C-DELTA in schools (see Table 3).

**Table 3: Teachers’ Responses on the Training of Trainers Workshop**

	Rating Scale		
	Excellent	Good	Poor
<b>Overall reaction to the workshop</b>	45%	55%	-
<b>To what extent the workshop was helpful in developing competencies:</b>	<b>To a Large Extent</b>	<b>Somewhat</b>	<b>Poor</b>
1. Understanding digital education leadership	75%	25%	-
2. Using the C-DELTA platform	65%	35%	-
3. Role as facilitating adoption of C-DELTA in your institution	55%	35%	10%
4. Building confidence in leadership roles to promote C-DELTA	70%	30%	-
<b>Development of digital education leadership skills:</b>	<b>Excellent</b>	<b>Very Good</b>	<b>Good</b>
1. Understanding digital identity	55%	40%	5%
2. Developing personal learning network	35%	50%	15%
3. Ability to explain digital education leadership to others	25%	65%	10%
4. Using the C-DELTA platform	15%	65%	20%
5. Strategies to promote digital education and C-DELTA	15%	65%	20%
	<b>Extremely</b>	<b>Very Much</b>	<b>Somewhat</b>
<b>Confidence to promote C-DELTA in school/institution</b>	25%	60%	15%

Teachers' satisfaction with the ToT workshop is further revealed by the following quotes:

It brought out my potentials as a leader and took me to dimensions of digital identity and safety which I had never thought before.

It helps to build a healthy digital identity and digital footprint through the C-DELTA platform.

However, they faced some challenges with engagement in the C-DELTA platform, due to English language limitations.

There were many terms that we couldn't understand.

Change the platform to support the language barriers and cultural differences.

Teachers' overall responses revealed their development of capacity and confidence to move forward with the C-DELTA Programme in their schools, as digital education leaders.

Concept mapping strategy was used as a graphical tool to support organizing and representing the developed knowledge (Novak & Cañas, 2008) and perspectives of teachers and students during the intervention.

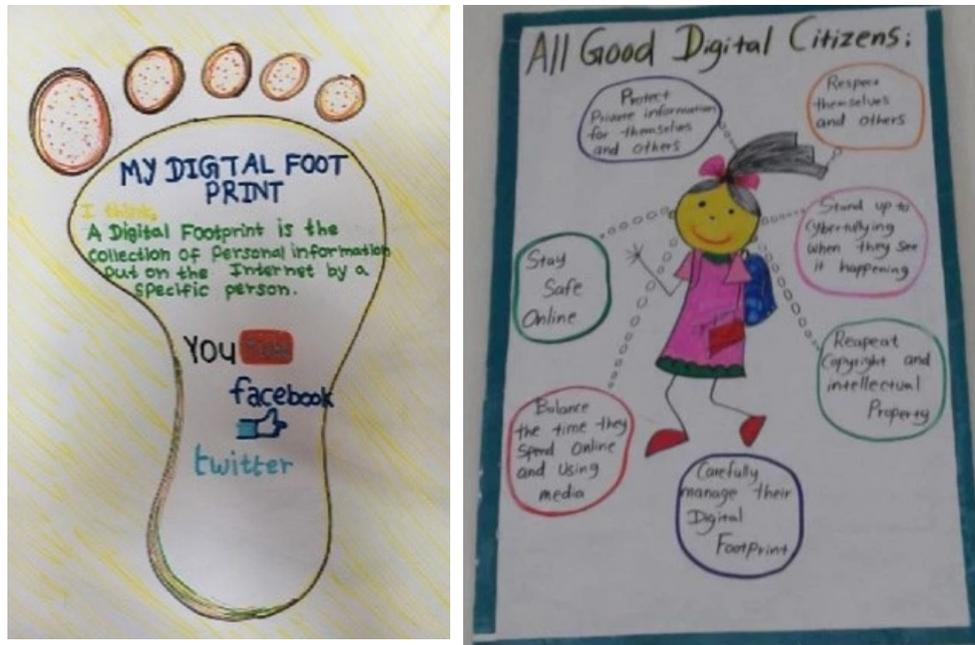
At the ToT workshop, initially, 41 individual concept maps were developed by the coordinating teachers. Structural analysis of these concept maps revealed that most of these were presented either in a "Spider" format – centrally located main theme surrounded by the sub-themes; or in a "Flow chart" format – information logically presented in an orderly way with a clear flow of ideas. The content analysis of the concept maps indicated an organised presentation of their initial understandings around the key concepts such as C-DELTA and digital education, and sub-concepts such as "digital identity", "digital footprints" and "digital literacy".

Based on their individual concept maps, later, teachers created group concept maps/posters depicting their collective understanding of these concepts (see Figure 2).



Figure 2: Group Concept Maps/Posters Created by Teachers.

Interestingly, during school implementation of the interventions, students also have created concept maps/posters visualizing their understandings on these novel concepts (see Figure 3).



**Figure 3: Concept Maps/Posters Created by Students.**

It was also revealed that such terms were novel to both teachers and students, and that they were very interested in learning more about these concepts.

### **Usage of the C-DELTA Platform by Teachers and Students**

According to log records in the C-DELTA platform, the number of registered teachers and students in the C-DELTA platform showed a gradual increase during the intervention (see Table 4).

**Table 4: Teachers and Students Registered in the C-DELTA Platform**

Month	No. of Teachers (Including Coordinating Teachers)	No. of Students
July 2018	41	01
August 2018	54	11
September 2018	59	16
October 2018	111	74
November 2018	155	196
January 2019	163	202

However, the actual usage rates of the C-DELTA Platform by both teachers and students in terms of completing pre-tests and post-tests was not found to be quite satisfactory (see Figures 4 and 5).

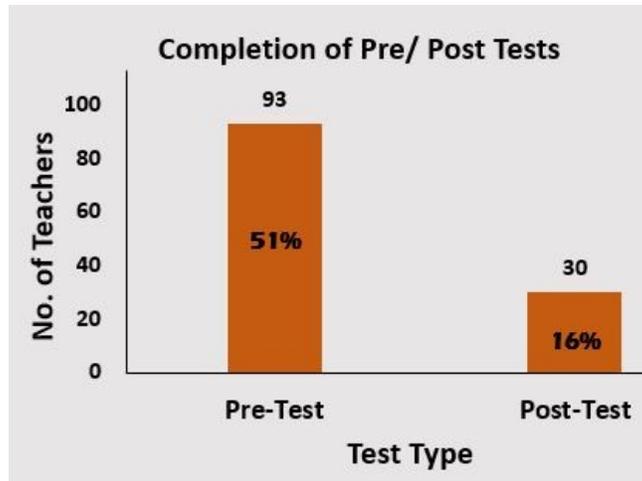


Figure 4: Completion of Pre- and Post-Tests by Teachers.

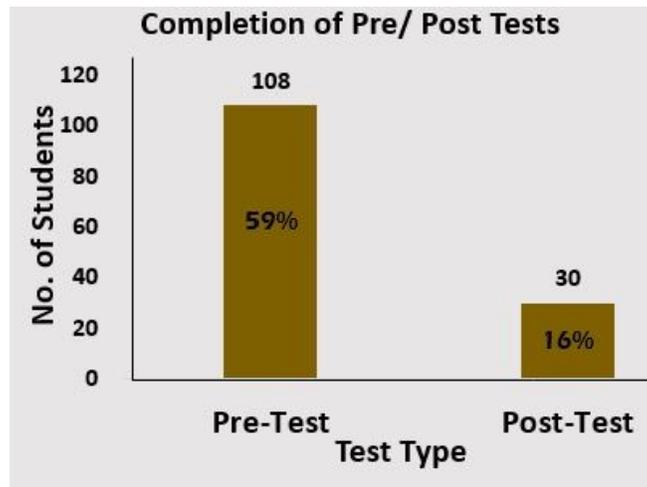


Figure 5: Completion of Pre- and Post-Tests by Students.

Similarly, completion of the modules in C-DELTA was observed to be slow by both teachers and students (see Table 5).

Table 5: Completion of Modules by Teachers and Students

Module No.	Teachers		Students	
	Count	%	Count	%
Module 1	58	31.87	58	31.87
Module 2	37	20.33	30	16.48
Module 3	31	17.03	25	13.74
Module 4	47	25.82	-	-
Module 5	26	14.29	-	-
Module 6	20	10.99	-	-
Module 7	19	10.44	-	-

This slow progress was mainly due to various challenges faced by the teachers, as revealed by the focus group discussions and teacher reflections during mid- and post-intervention.

### **Challenges, Supports and Suggestions**

The coordinating teachers had faced several challenges during the implementation process in schools as follows:

- Difficulty of selecting students and teachers for the project.
- Poor involvement of students and teachers in the planned activities.
- Limited English language proficiency of teachers and students.
- Limited ICT competency among students and teachers
- Inadequacy of computer and internet facilities in the schools.
- Slow Internet connectivity.
- Difficulty in scheduling and conducting orientation sessions, due to various school activities.
- Limited time to engage with the project due to heavy workload in schools, and personal issues.

Nevertheless, several supportive factors enabled them to manage these challenges to some extent:

- Support extended by the Principal to introduce and implement this project in the school.
- Interest and motivation of students and teachers in involvement in project activities.
- Curiosity about involvement in online activities.
- Google Translator and online dictionaries helped to solve English language difficulties.
- Certificate issued by Commonwealth of Learning (COL) helped to motivate and engage in activities.

The pre/post testing in the C-DELTA platform and certification was found to be a motivation to proceed:

I did not want to give up until I get the certificate for both pre-test and post-test, I was so happy when I got the certificates. (Student)

This is incredible, I feel like I have completed the final level of a computer game. (Student)

I feel very happy to have completed 6 modules out of 7 of the C-Delta program. I scored a total of 62 on the Post test at my first attempt and got the intermediate certificate. (Teacher)

Participants also made some suggestions to support them further such as, including a Glossary, Search Bar, a Help page, as well as the inclusion of pictures, videos and voice recordings to the content. Further, they proposed allocating more time for Pre/Post-testing with provision of instant feedback.

### **Teacher Reflections**

Teachers reflected upon their experience at different stages of the intervention by answering three simple questions; “What?” “So what?” and “Now what?” (Rolfe et al, 2001). Table 4 indicates teacher reflections received at the end of the ToT workshop.

**Table 4: Teacher Reflections after the ToT Workshop**

Question	Description	Supportive Teacher Quotes
<b>What?</b>	Describe the situation: achievements, consequences, responses, feelings, and problems	The experience of C-DELTA programme is good... At the beginning, it was very difficult to understand some concepts about digital education ...
<b>So what?</b>	Discuss what has been learnt: learning about self, relationships, models, attitudes, cultures, actions, thoughts, understanding, and improvements	I have learnt many things ... digital education, digital learning, digital footprint and now I know how to create a good foot print through the cyber space... I used Google Translator/Madura Dictionary to identify the meaning of some difficult words ...
<b>Now what?</b>	Identify what needs to be done in order to improve future outcomes, and develop learning	I understood the importance of sharing this knowledge with my staff members and my students ... I must teach my students to how to use internet safely and...the uses we can get through the internet ...

As revealed by the above data, initially, a very positive response and high motivation was observed among the coordinating teachers about implementing the C-DELTA initiative.

During mid-intervention and post-intervention, teachers continuously reflected on their experiences, which revealed their successes, challenges, supports, achievements, and future plans (see Table 6).

**Table 6: Successes, Challenges, Supports, Achievements, Good Practices and Future Plans**

Categories	Codes
Successes	<ul style="list-style-type: none"> <li>• Awareness on Digital Identity and Digital Footprint</li> <li>• Improving digital learning skills</li> <li>• Improving digital educational leadership skills</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>• The allocation of time for C-DELTA activities</li> <li>• Language barrier</li> <li>• Lack of computer facilities in the schools</li> <li>• Slow internet connectivity</li> <li>• Poor motivation of teachers</li> </ul>
Supports	<ul style="list-style-type: none"> <li>• Good support of Principal/Head master/Sectional heads</li> <li>• Support of students and other teachers</li> <li>• Support of parents of students</li> </ul>
Achievements	<ul style="list-style-type: none"> <li>• Enhancing knowledge of ICT both students and teachers</li> <li>• Experiencing online learning and online testing</li> <li>• Improving skills of concept mapping</li> <li>• Receiving computer and Internet facilities to ICT labs</li> </ul>
Future Plans	<ul style="list-style-type: none"> <li>• Introduce the C-DELTA programme to all Advanced level students</li> <li>• Increase student and teacher participation in the programme</li> <li>• Include the C-DELTA programme to the school year plan</li> <li>• Propose curriculum specialists to include the C-DELTA programme into school ICT curriculum</li> </ul>

The participant teachers' reflections compiled as "stories", were published online as "*Digital Education Leaders in Action*", and released with a CC BY-SA license, to openly share these experiences as a basis to promote further interventions (see <https://cdeltaouisl.wordpress.com/>).

## **Impacts**

Based on the findings, the key impacts of the C-DELTA programme on the teaching-learning process were revealed as follows:

- Both teachers and students have enhanced their digital literacy skills, and, thus, became more confident and efficient in using digital content and tools to support the teaching-learning process.
- Exposure to novel concepts such as 'digital identity', 'digital footprint' and 'digital education' have been very useful for teachers and students, in changing their thinking and practices to be more aware of digital safety and maintaining a positive digital identity when engaging with digital environments.
- Creation of concepts maps and posters to visual their perspectives on digital concepts have stimulated critical thinking and creative thinking among teachers and students.
- Encouraging students to use digital tools and to create digital artefacts, such as PowerPoint presentations and videos, has increased their motivation to use ICT in the teaching-learning process.
- Doing pre/post-tests online has been a novel experience for students and enabled them to face the newly introduced online examinations for General Information Technology (GIT), more confidently.
- After the C-DELTA experience teachers tend to apply more student-centred methods in the teaching- learning process, such as exploration and discovery; use of digital tools, advanced search engines and Open Educational Resources (OER).
- Teachers could convince school authorities to expedite purchasing new computers and getting Internet connectivity, to support C-DELTA activities.
- C-DELTA programme has instilled an increased interest and motivation among teachers and students about the future digital classrooms, and becoming digital citizens.

Overall, the patterns of the findings indicate consistency with the conceptual framework of C-DELTA (see Fig. 1). The main aim of the intervention process was, to provide direction to the participant teachers towards adopting digital education by enhancing access to digital learning, developing capacity and cultivating innovation. This has enabled development of their digital education leadership skills, as seen by the pedagogic interventions they have implemented in their own schools, initiating changes in mindsets and behaviours to enhance digital education (Gorton, 2018; Sheninger, 2014). The digital education practices of these teachers have resulted in fostering digital literacy among students and peer teachers in their schools. As such, it was evident by this study, that via digital education leadership development and the resulting digital education practices, the learning goal of digital literacy as a social practice (Brown et al, 2016) could be achieved.

## Concluding Remarks

Adoption of the C-DELTA Programme has been a novel experience embraced by the participant teachers who were very motivated to implement it in their schools. However, the implementation of C-DELTA has been hindered in some schools, due to various practical issues faced by the teachers, such as time constraints, limitation in English language competencies, and inadequate ICT facilities. Despite such challenges, many teachers willingly implemented the C-DELTA Programme in their schools with commitment, managing the constraints as much as possible.

The findings clearly portray how the adoption of C-DELTA has impacted the teaching-learning process by developing and enhancing digital learning skills among teachers and students, and changing their thinking and practices. It was evident that the intervention has supported the participant teachers to become effective professionals who can cater to the digital education environments in their institutions. Overall, the implementation of the C-DELTA programme has helped enhance participant teachers' digital education leadership skills, and provided them with an avenue to promote digital education in their schools through innovative thinking and application of novel teaching-learning strategies to create digital learning environments.

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