# Adoption of C-DELTA Programme by Sri Lankan Teachers and Students

S.P. Karunanayaka, W.M.S. Weerakoon, N.M.R.K. Nawaratne, S. Karunanayake, J.D. Careemdeen
*Faculty of Education, The Open University of Sri Lanka*

**Abstract**

The Commonwealth Digital Education Leadership Training in Action (C-DELTA) programme provides a framework for fostering digital learning for lifelong learning by developing leaders who can influence others to use digital technology appropriately and effectively for learning. The Faculty of Education at the Open University of Sri Lanka (OUSL) implemented an action research project, with the aim of promoting the adoption of C-DELTA among the teachers and students of secondary schools in Sri Lanka. It comprised an intervention designed to facilitate the adoption of C-DELTA in secondary schools, and evaluation of its impact on the teaching-learning process. A group of 41 participant teachers representing schools from the nine Provinces of Sri Lanka coordinated the implementation of C-DELTA in their schools. A variety of data collected using concept maps, questionnaires, focus group interviews, implementation reports, and logs recorded in the C-DELTA platform were analysed using both quantitative and qualitative methods. Findings revealed that while adoption of C-DELTA was a novel experience highly embraced by the participant teachers who were very motivated to implement it in their schools, various constraints have hindered its successful implementation. Despite facing challenges including inadequate ICT facilities, time constraints and limitation in English language competencies, 21 teachers who completed the project reflected that adoption of C-DELTA in the teaching-learning process has supported improving digital literacy among students and teachers. For instance, concepts such as 'digital foot print' and 'digital identity' were found to be most effective in enacting changes in thinking and digital behaviour among both students and teachers. Overall, the implementation of C-DELTA has enhanced participant teachers' digital education leadership skills, and provided them with an innovative avenue to promote digital education in their schools.

**Key words:** - C-DELTA, Digital Education, Digital Education Leadership, Digital Learning

## Introduction

Fostering digital education has become a necessity in the present age of digitalization. Commonwealth Digital Education Leadership Training in Action (C-DELTA) programme of the Commonwealth of Learning (COL) provides a framework for fostering digital learning and developing skilled citizens for lifelong learning (see https://cdelta.col.org/). Digital education leaders are the people who demonstrate effective use of information and communication technology for teaching, and who advocate, influence and build capacity of others. The C-DELTA programme provides an avenue to develop digital competencies of individuals. This online learning platform provides access to seven modules related to digital education. Teachers and students who register on the platform can assess their digital education skills and learn more to upgrade their current level through self-learning. The curriculum and learning modules of C-DELTA were developed by the University of Cape Town (UCT), 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.

The Faculty of Education of the Open University of Sri Lanka (OUSL), with the support from COL, implemented a research project in 2018, to promote the adoption of C-DELTA programme in Sri Lankan schools. 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. It specifically aimed at facilitating the adoption of C-DELTA by teachers and students of the secondary school level in Sri Lanka, and evaluate its impact on student learning and teacher's pedagogical practices. This paper reports the study conducted to explore how and in which ways the adoption of C-DELTA was having an impact on the teaching-learning process in the secondary school level in Sri Lanka.

**Review of Literature**

Digital technologies are increasingly changing our daily life practices. Digital skills have become an essential need in order to accommodate the rapidly developing digital demands in this era. Nevertheless, today's children, who are termed 'digital-age learners' (Collier, 2013), readily engage with numerous innovative digital devices with ease. Their enhanced knowledge and skills on the use of digital technologies should be positively applied for academic purposes, which requires changes in conventional educational 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, 2006). 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'*) lead to skill development ('*I can'*), which in turn lead 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 the his/her digital practices. This suggests some key aspects to consider when planning digital education programmes.

Despite the increased technology integrations 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 the leadership in using the technology in order to enhance the organizational output (Briggs, 2017; Rouse, 2007). With the growing significance of digital education needs, leadership development in digital education has 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 lead 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, behaviors, and skills to change a school culture (Sheninger, 2014). Such digital leadership qualities need to be developed in a systematic manner.

Various models and frameworks that have been presented in relation to leadership in e-learning, educational technology, and digital education provides some useful insights (Bennette, 2014; Jameson, 2013; Hughes, Thomas & Scharber, 2006; Mishra et al., 2016; Sharpe & Beetham, 2010). For instance, the 'Digital Practitioner Framework' (Bennette, 2014) provides a comprehensive perspective on how digital education leadership competencies can be developed in terms of access, skills, practices, attributes. Similarly, Jameson (2013) presented a leadership framework comprising purpose, people, structures and social systems, targeting development of e-leadership in higher education. 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 the digital education (Ministry of Education, Sri Lanka, 2011, Srivastava & Dey, 2018). Recognizing the need to develop leadership in this area, several policy level decisions have been made within the Sri Lankan context. Numerous initiatives have been launched to expand the facilities needed to enhance digital learning within the Sri Lankan schools. 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 the digital literacy among learners. (Ministry of Education, Sri Lanka, 2011). Further the importance and need of training teachers on 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**

The C-DELTA programme is developed based on the conceptualisation of a holistic approach to digital education leadership. 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)

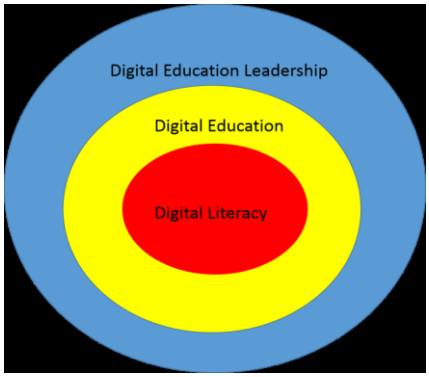


Fig. 1: A holistic view of digital education leadership *(Source: Brown et al. 2016, p. 10)*
*Attribution:* <http://oasis.col.org/handle/11599/2442 > *(CC BY*-SA)

Accordingly, digital literacy as a social practice is the core. It 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 drives fostering of digital literacies. Digital education leadership is about providing direction in terms of digital education by enhancing access, capacitating peers, making informed decisions and cultivating innovation, to achieve the learning goal of digital literacy (Brown et al. 2016).

In the context of C-DELTA, digital education is described as the 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 emphasizes enhancing capacity building in context-based digital literacy practices. Hence, a need for digital education leaders who can take leadership in fostering digital literacies relevant to their contexts is specified. These leaders can foster digital literacies via 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. They will be change agents in their own contexts (Brown et al. 2016).

The current study was planned and implemented, grounded on the above conceptual framework of C-DELTA.

**Methodology**

***Research Design***

The study adopted an action research approach, which is a form of self-reflective inquiry undertaken by participants in social situations to improve their practices (Carr & Kemmis, 1986; Masters, 1995). It is a systematic and an iterative process comprising four stages - planning, acting, observing and reflecting. Action research is of a collaborative nature 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 improving educational practices by change, through a dynamic process.

Within the action research methodological framework, the research team engaged in a systematic process of activities. It comprised the design and implementation of an intervention programme for participant teachers to promote the adoption of C-DELTA programme in their schools, and the evaluation of its impact on the teaching-learning process. In

turn, the participant teachers themselves employed small-scale action researches in their schools, to implement C-DELTA project and evaluate its effect. Teachers who employ action research as 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 useful methodological framework, to improve educational practices in real life situations of practitioners.

***Aim and Objectives***

In line with the main aim of the study, 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:

1. To review the existing level of digital education practices among the participant teachers
2. To design an intervention programme to promote the adoption and implementation of C-DELTA programme in schools
3. To implement the intervention comprising capacity building 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 were purposively selected from among the student teachers 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 medium 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

Selected participants were 41 graduate teachers, from 39 schools. Table 1 indicates the participant teacher distribution.

Table 1- Distribution of Participant Teachers

| Province | No. of Teachers | Medium of Teaching | | Gender | |
|---|---|---|---|---|---|
| | | Sinhala | Tamil | Male | Female |
| 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 |
| **Percentage** | **100%** | **65.9** | **34.1** | **41.5** | **58.5** |

***The Process***

The research process was conducted in several steps according to the four stages of the action research cycle. (See Table 2).

Table 2: Key Activities Conducted During the Intervention

| Stage | Activities | Data collection strategy |
|---|---|---|
| Plan | 1. Reviewing the existing levels of digital education practices among the participant teachers | Pre-intervention questionnaire |
| | 2. Design of an intervention including different strategies and tools to promote the adoption of C-DELTA in the 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 reflections (Evaluation Workshops, Writing Workshops) | Teachers' Final reports, Reflective narratives |
| | 6. Open sharing of experiences as a basis to promote further interventions | Website of sharing experiences as 'stories' |

***Planning the Intervention***

The preliminary questionnaire survey revealed the participant teachers' existing level of ICT practices. They possessed adequate ICT skills, 40% as 'Excellent' and 60% as 'Average' as claimed by them, and all of them integrated ICT in their teaching-learning process. Further, 80 % of the teachers claimed an 'Average' level, and 20% an 'Excellent' level, of English language proficiency. The teachers' main expectations in participating in the C-DELTA project were, to develop digital education skills among teachers and students, to improve their ICT skills and leadership skills, and to give new knowledge for schools. Several challenges anticipated were indicated as time constraints, lack of support from other teachers, limited ICT and English language skills of students, and inadequacies in the computer and Internet facilities. This preliminary analysis indicated that the participants were 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 promote and facilitate the adoption of C-DELTA in their schools. 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 supported the participant teachers to understand the concepts underpinning the C-DELTA curriculum, and to prepare implementation plans to conduct C-DELTA in their own schools as mini-action researches.

***Implementing and Monitoring the Intervention***

Planned activities were implemented in the schools from August 2018 to February 2019. Initially, the participant (coordinating) teachers were mainly engaged in getting familiar with the C-DELTA platform themselves, by studying the modules and completing the activities. Next, they implemented their mini-action research cycles, comprising the following activities:

- Conduct of an orientation session for the secondary school students and teachers to make them aware of the C-DELTA platform.
- Encourage students and teachers to register and take up the C-DELTA modules online over a period of six months.
- Provide support and guidance as required to those who took up the modules of C-DELTA.
- Design and develop learning activities to improve digital literacy among students.
- Monitor, evaluate and reflect upon their implementation process.

While these activities were ongoing, the research team engaged in constant monitoring of teachers' and students' online engagement with the C-DELTA platform, 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 discovered mainly through the participant teachers' self-reflections revealed during the final evaluation workshops. Out of the 41 teachers, only 21 teachers participated in the evaluation workshops and submitted their final reports.

**Collection and Analysis of data**

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

**Findings and Discussion**

**Pre-Intervention**

***Teacher Perceptions on the ToT Workshop***

All teachers (100%) expressed that the ToT workshop was Excellent/Very Good, and that their expectations were fully met. (see Table 3).

Table 3: Teachers' Responses on the ToT Workshop

| **To what extent do you think the workshop was helpful in developing the following competencies?** | **Rating Scale** | | |
|---|---|---|---|
| | **To a large extent** | **Somewhat** | **Poor** |
| 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% | - |
| **Please rate your skills on digital education leadership after this workshop.** | **Excellent** | **Very Good** | **Good** |
| 1. Understanding my 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% |
| | **Extremely** | **Very much** | **Somewhat** |
| **After attending the workshop, how confident are you to promote C-DELTA in your school/institution?** | 25% | 60% | 15% |

Teachers' satisfaction with the workshop is further supported with 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 due to the 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 development of confidence to move forward as digital education leaders in their schools, with the C-DELTA Programme.

***Concept Mapping***

Concept mapping strategy was used as a graphical tool for organizing and representing knowledge (Novak & Caňas, 2008). During the ToT workshop, 41 individual concept maps developed by the teachers were analyzed considering their structure and content. Structural analysis revealed that most of the concept maps were presented as either as 'Spider' (centrally located main theme surrounded by the sub-themes) or 'Flow chart' (information logically presented in an orderly way with a clear flow of ideas). The content analysis indicated an organized 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 the individual concept maps, group concept maps/posters were created. (Fig. 2)

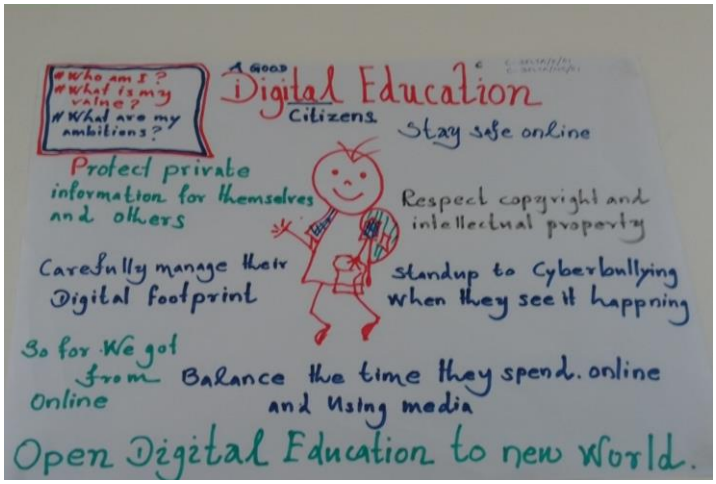


Fig. 2: Sample Group Concept Map/Poster

It was revealed that the terms "Digital Identity" and "Digital Foot print" were novel to the participants and they were very interested in learning more about these concepts.

***Teacher Reflections***

Teachers reflected upon their ToT experience by answering three simple questions; "What, So what and Now what" (Rolfe et al., 2001). (See Table 4).

Table 4: Teacher Reflections after the ToT Workshop

| Question | Description | Supportive Teacher Quotes |
|---|---|---|
| **What?** | Describe the situation; achievements, consequences, responses, feelings, and problems | *"The experience of C-DELTA programme is good…"*<br>*"We learned lot of things relevant to Digital education…"*<br>*"At the beginning, it was very difficult to understand some concepts about digital education…"* |
| **So what?** | Discuss what has been learnt; learning about self, relationships, models, attitudes, cultures, actions, thoughts, understanding, and improvements | *"I have learnt many things with regard to digital education, digital learning, digital footprint and now I know how to create a good foot print through the cyber space…"*<br>*"I used Google Translator/Madura Dictionary to identify the meaning of some difficult words…"* |
| **Now what?** | 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…"*<br>*"I must teach my students to how to use internet safely and what are the uses we can get through the internet…"* |

The initial analysis of data revealed a very positive response and motivation among the coordinating teachers about implementing the C-DELTA initiative. All of them created implementation plans.

**Mid-Intervention**

***Usage of C-DELTA Platform by teachers and students***

Overall, the number of registered teachers and students in the C-DELTA platform showed a gradual increase during the intervention. (Fig. 3)

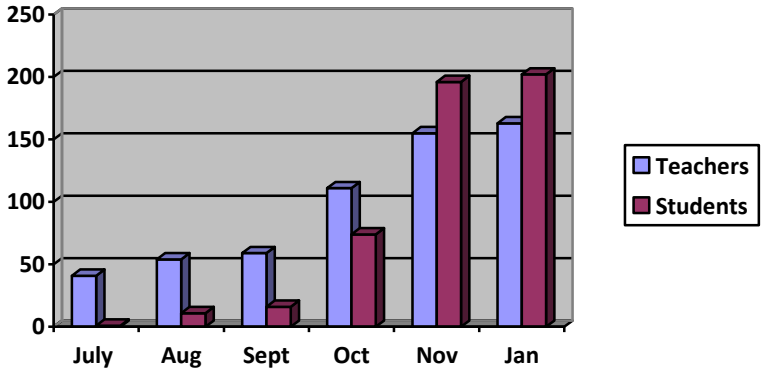


Fig. 3: Progress in the use of C-DELTA Platform

However, the overall course completion rate was not quite satisfactory. (See Fig. 4).

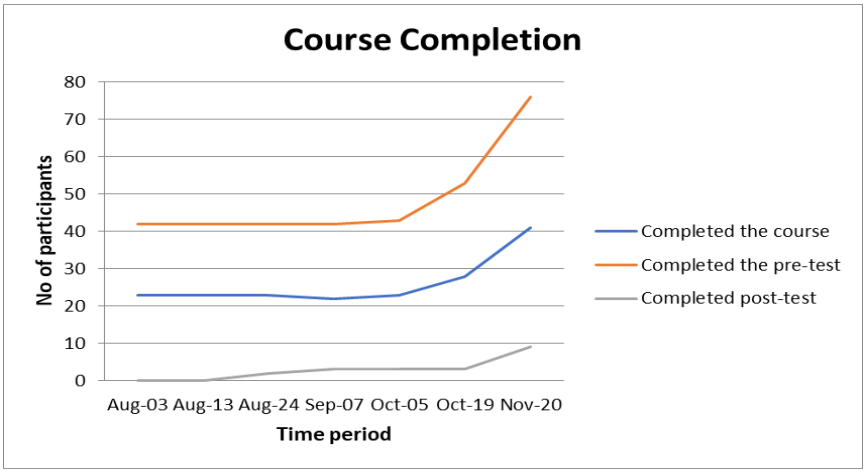


Fig. 4: Trend analysis in the completion rates of C-DELTA by teachers

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

Table 5: Completion of Modules by Teachers and Students

| Module No. | Teachers | | Students | |
|---|---|---|---|---|
| | Count | Percentage (%) | Count | Percentage (%) |
| 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 due to various challenges, as revealed during the mid-intervention school visits.

***Challenges, Supports and Suggestions***

The coordinating teachers faced several challenges during the implementation process 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

However, 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 to 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 such as, including a Glossary/Search Bar/Help page, inclusion of pictures/videos/voice to the content, and allocating more time for Pre/Post-testing with provision of instant feedback.

**Post-Intervention**

***Teacher Reflections***

The teachers' reflections made at the end of the process revealed their successes, challenges, supports, achievements, and future plans. (See Table 6)

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

| Categories | Codes |
|---|---|
| Successes | • Awareness on Digital Identity and Digital Footprint<br>• Improving digital learning skills<br>• Improving digital educational leadership skills |
| Challenges | • The allocation of time for C-DELTA activities<br>• Language barrier<br>• Lack of computer facilities in the schools<br>• Slow internet connectivity<br>• Poor motivation of teachers |
| Support | • Good support of Principal/Head master/Sectional heads<br>• Support of students and other teachers<br>• Support of parents of students |
| Achievements | • Enhancing knowledge of ICT both students and teachers<br>• Experiencing online learning and online testing<br>• Improving skills of concept mapping<br>• Receiving computer and Internet facilities to ICT labs |
| Future Plans | • Introduce C-DELTA programme to all Advanced level students<br>• Increase student and teacher participation in the programme<br>• Include C-DELTA programme to the school year plan<br>• Propose curriculum specialists to include C-DELTA programme into school ICT curriculum |

***Impacts***

The key impacts of the C-DELTA on the teaching-learning process were revealed as follows:

- The concepts of 'digital identity' and 'digital footprint' have been useful for teachers and students, in changing their thinking and practices to be more aware of digital safety and maintaining a positive digital identity.
- Both teachers and students have enhanced their digital literacy skills, and thus becoming more confident in using digital content and tools in the teaching-learning process.
- Doing pre/post-tests online was a novel experience for students, which enabled them to face the General Information Technology (GIT) online examinations more confidently.
- Teachers tend to apply more student-centred methods in the teaching- learning process, such as exploration and discovery, using digital tools, advanced search engines and OER.
- Students are encouraged to create concepts maps, PowerPoint presentations, posters, and videos, and thus, usage of ICT in the teaching-learning process has been increased.

- Teachers could convince school authorities to expedite purchasing new computers and getting Internet connectivity, to support C-DELTA activities.
- Increased interest and motivation among teachers and students about the future digital classrooms, and becoming digital citizens.

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 our experiences as a basis to promote further interventions. (See <https://cdeltaousl.wordpress.com/>)

The patterns of the findings indicate consistency with the conceptual framework of C-DELTA (Fig. 1). The main aim of the intervention implemented with the coordinating teachers was, to provide direction towards 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 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 that through the digital education leadership development and the resulting digital education practices, the learning goal of digital literacy as a social practice (Brown et al. 2016) can be achieved.

**Concluding Remarks**

Adoption of the C-DELTA Programme was a novel experience highly 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 on 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 C-DELTA programme has helped enhancing 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.

**Acknowledgements**
The project work that is reported in this paper has been supported by the Commonwealth of Learning (COL).

**References**

Avolio, B., Sosik, J., Kahai, S., & Baker, B. (2014). E-leadership: Re-examining transformations in leadership source and transmission. *The Leadership Quarterly, 25*, 105–131

Beetham, H., McGill, L., & Littlejohn, A. (2009) *Thriving in the 21st century: Learning literacies for a digital age.* Retrieved from https://www.researchgate.net/publication/267259433_Thriving_in_the_21st_century_Learning_Literacies_for_the_Digital_Age_LLiDA_project_Thriving_in_the_21st_century_Learning_Literacies_for_the_Digital_Age_LLiDA_project

Bennett, L. (2014). Learning from the early adopters: Developing the digital practitioner. *Research in Learning Technology*. *22*. 21453. Retrieved from http://researchinlearningtechnology.net/index.php/rlt/article/view/21453.

Briggs J., (2017). *What is a Digital Leader?* Retrieved from https://www.ionology.com/what-is-a-digital-leader/

Brown, C., Czerniewicz, L., Huang, C., & Mayisela, T. (2016). *Curriculum for Digital Education Leadership: A Concept Paper*. Retrieved from http://oasis.col.org/handle/11599/2442

Bryant, P. (1995). Collab*orative action research on the cutting edge*. Retrieved from https://opus.uleth.ca/bitstream/handle/10133/849/Bryant_Paul.pdf

Carr, W., & Kemmis, *S*. (1986). *Becoming critical Education, knowledge and action research.* London: Falmer.

Collier, D., Burkholder, K., & Branum, T. (2013). *Digital Learning: Meeting the Challenges and Embracing the Opportunities for Teachers.* Retrieved from https://files.eric.ed.gov/fulltext/ED544368.pdf

Fisk, P. (2002). *The Making of a Digital Leader, Business Strategy Review*. *13* (1). 43-50. Retrieved from http://www.blackwellpublishing.com/content/BPL_Images/Journal_Samples/BUSR0955-6419~13~1~198/201.PDF

Geer, B., White, B., Zeegers, Y., Au. W., & Barnes, A. (2017) Emerging pedagogies for the use of iPads in schools, *British Journal of Educational Technology*. *48* (2). 490-498. Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1111/bjet.12381

Gorton. C., (2018). *6 characteristics of digital leadership*. Weblog. Retrieved from https://digileaders.com/6-characteristics-digital-leadership/

Hughes, J., Thomas, R., & Scharber, C. (2006). Assessing technology integration: The RAT—replacement, amplification, and transformation—framework. In C. Crawford, et al. (Eds.), *Proceedings of society for information technology & teacher education international conference* 2006, Retrieved from http://techedges.org/wp-content/uploads/2015/11/Hughes_ScharberSITE2006.pdf

Jameson, J. (2013). e-Leadership in higher education: The fifth "age" of educational technology research. *British Journal of Educational Technology*. *44* (6), 889–915.

JISC (2015). *Developing students' digital literacy*. Retrieved from https://www.jisc.ac.uk/guides/developing-students-digital-literacy.

Kihoza,P.,I. Zlotnikova ,Bada,J., Kalegele,K., (2016) Classroom ICT integration in Tanzania: Opportunities and challenges from the perspectives of TPACK and SAMR models. *International Journal of Education and Development using Information and Communication Technology (IJEDICT). 12* (1). 107-128. Retrieved from https://pdfs.semanticscholar.org/f713/af0b583ce468ec747fc5f97e2dae6c383f4e.pdf

Kimmons, R., Miller, B., Amador, J., Desjardins, C., & Hall, C. (2015). Technology integration coursework and finding meaning in pre-service teachers reflective practice. *Educational Technology Research and Development*. *63* (6). 809–829. Retrieved from https://link.springer.com/article/10.1007/s11423-015-9394-5

Lynch, M. (2018). *How educators can become digital leaders*. Retrieved from https://www.thetechedvocate.org/how-educators-can-become-digital-leaders/

Martin A. (2008). Digital literacy and the "digital society". In C. Lankshear & M. Knobel (Eds.), *Digital literacies: Concepts, policies and practices* (pp. 151–176). New York, NY: Peter Lang.

Masters, J. (1995) 'The History of Action Research' in I. Hughes (ed) *Action Research Electronic Reader,* The University of Sydney. http://www.behs.cchs.usyd.edu.au/arow/Reader/rmasters.htm Retrieved from www.iopp.ru/pub/21sept06_M2.doc

McGill, L., Meadon, L., Moore, D., Gunness, S., Rampersad, R., Brown, C., & Pancham, K. (2017). Commonwealth Digital Education Leadership Training in Action (C-DELTA). Retrieved from http://oasis.col.org/handle/11599/2926

McLeod, S. (2015). The challenges of digital leadership. *Independent School. 74* (2), n.p. Retrieved from http://www.nais.org/Magazines-Newsletters/ISMagazine/Pages/The-Challenges-of-Digital-Leadership.aspx

Ministry of Education, Sri Lanka. (2011). *New Vision for Education*. Retrieved from http://www.moe.gov.lk/english/images/publications/New_Vision2010/new_vision2010.pdf

Ministry of Education, Sri Lanka. (2012). *New Vision for Education and Milestones of Progress*. Retrieved from http://www.moe.gov.lk/english/images/publications/New_Visionfor_Edu_milestones/report_e.pdf

Mishra, P., Henriksen, D., Boltz, L. O., & Richardson, C. (2016). E-leadership and teacher development using ICT. In R. Huang, Kinshuk, & J. K. Price (Eds.), *ICT in education in global context: Comparative reports of innovations in K-12 education.* Berlin, Germany: Springer. pp. 249–266.

Novak, J. D. & Cañas, A. J. (2008). *The theory underlying concept maps and how to construct and use them*. Ocala, FL: Florida Institute for Human and Machine Cognition. Retrieved from http://cmap.ihmc.us/Publications/ResearchPapers/TheoryUnderlyingConceptMaps.pdf

Phillips, M. (2015). *ICT is failing in schools – here's why*. Retrieved from http://theconversation.com/ict-is-failing-in-schools-heres-why-50890

Rolfe, G., Freshwater, D. & Jasper, M. (2001). *Critical reflection in nursing and the helping professions: A user's guide*. Basingstoke: Palgrave Macmillan.

Romrell, D., Kidder, L.C., & Wood, E. (2014). The SAMR Model as a Framework for Evaluating mLearning, *Journal of Asynchronous Learning Networks*. *18* (2) Retrieved from https://files.eric.ed.gov/fulltext/EJ1036281.pdf

Rouse, M. (2007). *Digital Leadership*. Retrieved from https://searchcio.techtarget.com/definition/digital-leadership

Selwyn, N. (2014). *Distrusting educational technology: Critical questions for changing times*. NY: Routledge.

Sharpe, R. & Beetham, H. (2010). Understanding students' uses of technology for learning: Towards creative appropriation', In R. Sharpe, H. Beetham, and S. de Freitas (Eds.) *Rethinking learning for a digital age: How learners are shaping their own experiences*. London: Routledge. pp.85-99.

Sheninger, E. (2014). *Pillars of Digital Leadership*. International Centre for Leadership in Education. Retrieved from http://leadered.com/pdf/LeadingintheDigitalAge_11.14.pdf

Srivastava, K. & Dey, S. (2018), Role of Digital Technology in Teaching-Learning Process, *IOSR Journal Of Humanities And Social Science (IOSR-JHSS). 23* (1). 74-79, Retrieved from https://www.researchgate.net/publication/323550837_Role_of_Digital_Technology_in_Teaching-Learning_Process