A Professional Learning Community Approach for Teacher Development and OER creation - A toolkit

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1 A Professional Learning Community Approach for Teacher Development and OER creation - A toolkit/Print version

This is the print version[1] of A Professional Learning Community Approach for Teacher Development and OER creation - A toolkit[2]
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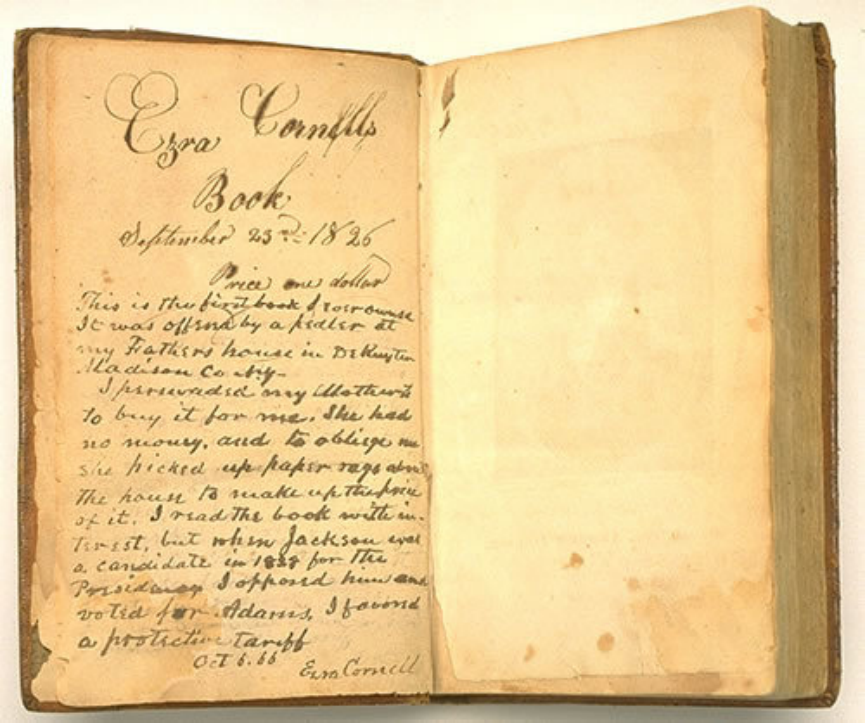
1 https://teacher-network.in/OER/index.php?title=Help:Print_versions&action=edit&redlink=1
2 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit
3 https://teacher-network.in/OER/index.php?title=A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/Print_version&action=purge&printable=yes



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A Professional Learning Community Approach for Teacher Development and OER creation - A toolkit

The current, editable version of this book is available at

[4]

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5 https://teacher-network.in/OER/index.php/Open_Educational_Resources:Copyrights

1.0.2 Introduction to the tool-kit

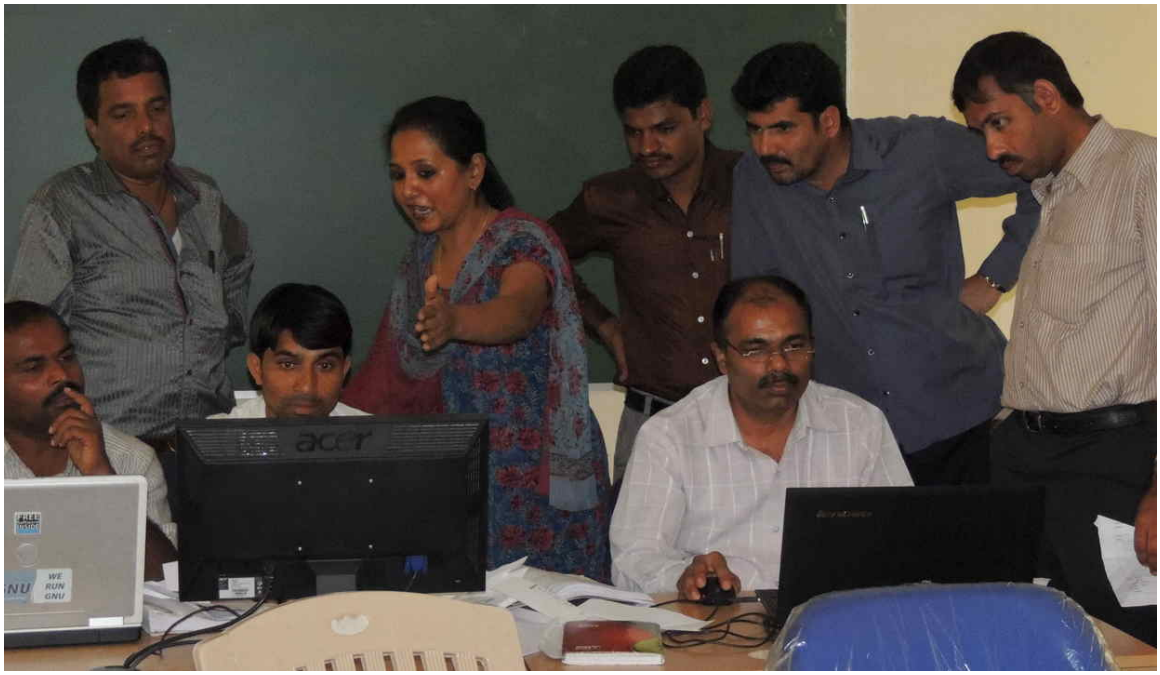

Figure 3 Collaborative mathematics material making, Subject Teacher Forum workshop, Bengaluru Urban DIET, Karnataka

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2 Preface

A Professional Learning Community Approach for Teacher Development and OER creation - A toolkit[1]

Preface Introduction to the tool-kit[2]

2.0.1 A tool-kit

The toolkit has been developed by IT for Change, an organization working with teachers and school systems on meaningful ICT integration, to support the aims of education. This toolkit is aimed at senior education officials to help them consider and plan for a similar program, adapting it to local context, needs and priorities. It is also for teacher educators and teachers, to support them to participate in the design and implementation of similar programs. Curriculum experts can use the toolkit for exploring digitally enabled participatory approaches to curriculum design and material development. Researchers can study the implementation of the tool-kit and provide evidenced-based inputs for improvement.

The toolkit is available in an on-line edition in the form of a "Wiki book[3]". The Wiki book edition can also be shared off-line on a DVD, which can enable user to read the digital version without internet connectivity. Along with the tool-kit, a custom software distribution which contains the FOSS desktop tools discussed in the tool-kit is shared on-line[4].

1 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit

2 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/Introduction_to_the_tool-kit

3 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit

4 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/Establishing_ICT_infrastructure

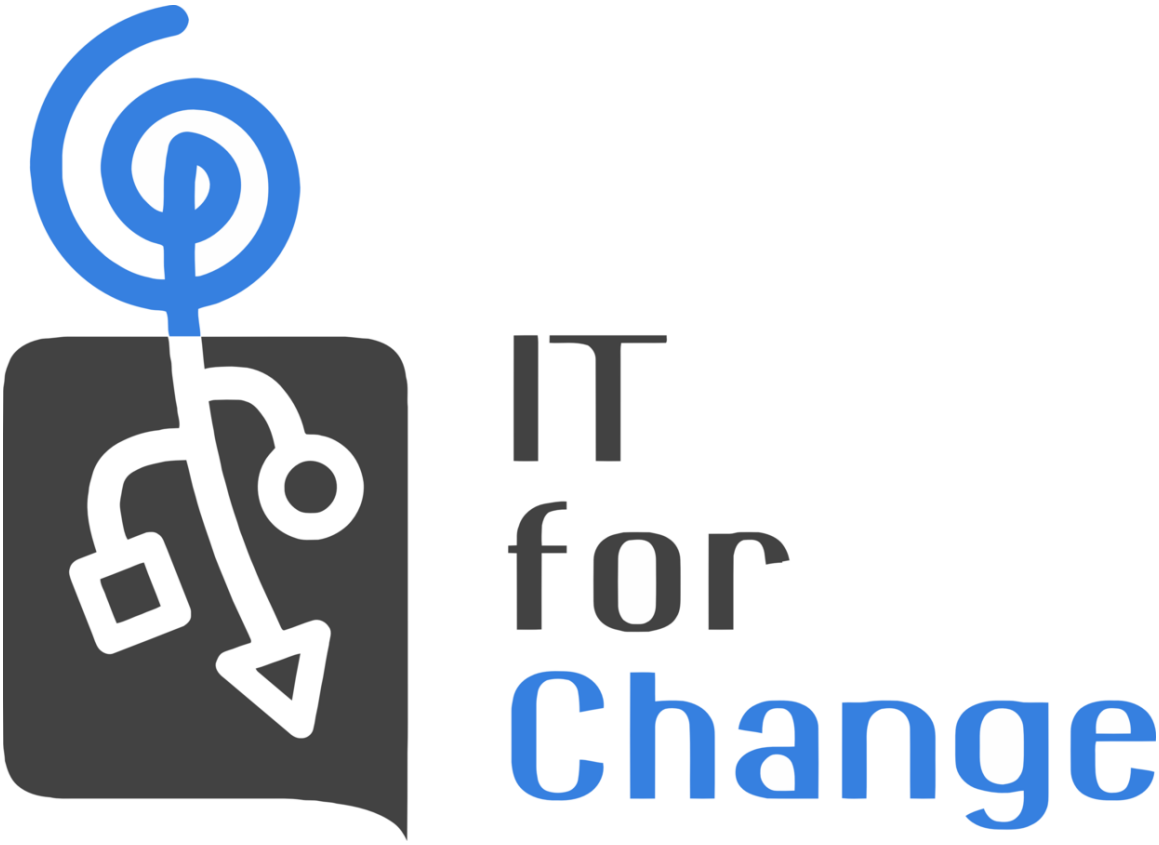

Figure 4 IT for Change

2.0.2 Author

Centre for Education and Technology, IT for Change[5], Bengaluru, India. Phone – 91-80-26654134, Mail[6] , Website[7]

The toolkit is written by a team[8] of researchers, editors, subject and technology experts from IT for Change[9], a NGO based in Bengaluru, India.

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9 http://ITforChange.net
10 http://itforchange.net/Guru
11 http://itforchange.net/ITfC-Directors

2.0.3 Copyright

2.0.4 Acknowledgements

The development of this toolkit was carried out with the aid of a grant from the International Development Research Centre[13], Ottawa, Canada, as a part of the Research on OER for Development[14] (ROER4D) research program.

The experiences from the Subject Teacher Forum program of Karnataka[15] and Telangana[16] informed the development of this toolkit. Acknowledgement is due to the education departments in both states, which invited ITfC to partner them in designing and implementing the program. ITfC's participation in the Subject Teacher Forum program in these two states was supported by CEMCA[17], Kotak Mahindra Bank CSR[18] and UNICEF[19].

The experiences from Karnataka Open Educational Resources[20] program and the Telangana Repository of Open Educational Resources[21] also informed the development of this toolkit. ITfC's participation in these programs was supported by CEMCA[22], Central Square Foundation[23], Kotak Mahindra Bank CSR[24] and UNICEF[25].

ITfC is currently being supported by Kotak Mahindra Bank CSR[26] in designing and implementing PLC-OER models across a few states in India.

12 https://creativecommons.org/licenses/by-sa/4.0/
13 http://idrc.ca/
14 http://roer4d.org
15 http://karnatakaeducation.org.in/KOER/en/index.php/Subject_Teacher_Forum
16 http://troer.telangana.gov.in/OER/index.php/Telangana_ICT_implementation
17 http://cemca.org.in
18 https://goo.gl/erN43f
19 http://unicef.org/
20 http://karnatakaeducation.org.in/KOER/en/index.php
21 http://troer.telangana.gov.in/OER/index.php/
22 http://cemca.org.in
23 http://centralsquarefoundation.org/
24 https://goo.gl/erN43f
25 http://unicef.org/
26 https://goo.gl/erN43f

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27 http://www.centralsquarefoundation.org/
28 http://cemca.org.in/
29 http://idrc.ca
30 https://kotak.com
31 http://unicef.org
32 https://creativecommons.org/licenses/by/4.0/

3 Introduction to the tool-kit

A Professional Learning Community Approach for Teacher Development and OER creation - A toolkit[1]

Preface[2] **Introduction to the tool-kit** **PLC-OER model of TPD**[3]

The status of the teacher reflects the socio-cultural ethos of a society; it is said that no people can rise above the level of its teachers. The Government and the community should endeavour to create conditions which will help motivate and inspire teachers on constructive and creative lines. Teachers should have the freedom to innovate, to devise appropriate methods of communication and activities relevant to the needs and capabilities of and the concerns of the community

- National Policy of Education, 1986 (NPE).[4]

Read more..

NPE (1986), Part IX: The Teacher

9.1 The status of the teacher reflects the socio-cultural ethos of a society; it is said that no people can rise above the level of its teachers. The Government and the community should endeavor to create conditions which will help motivate and inspire teachers on constructive and creative lines. Teachers should have the freedom to innovate, to devise appropriate methods of communication and activities relevant to the needs and capabilities of and the concerns of the community.

9.2 Teachers associations must play a significant role in upholding professional integrity, enhancing the dignity of the teacher and in curbing professional misconduct. National level associations of teachers, could prepare a Code of Professional Ethics for Teachers and see to its observance.

9.3 Teacher Education is a continuous process, and its pre-service and in-service components are inseparable. As the first step, the system of teacher education will be overhauled.

9.4 The new programmes of teacher-education will emphasis continuing education and the need for teachers to meet the thrusts envisaged in this Policy.

1 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit

2 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/Preface

3 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/PLC-OER_model_of_TPD

4 http://educationforallinindia.com/page58.html

9.5 ... Networking arrangements will be created between institutions of teacher education and university departments of education. 1986 says, ”The importance of competent teachers to the nation’s school system can in no way be overemphasized. It is well known that the quality and extent of learner achievement are determined primarily by teacher competence, sensitivity and teacher motivation. It is common knowledge too that the academic and professional standards of teachers constitute a critical component of the essential learning conditions for achieving the educational goals”

Important to reform and strengthen teacher development

The importance of competent teachers to the nation’s school system can in no way be overemphasized. It is well known that the quality and extent of learner achievement are determined primarily by teacher competence, sensitivity and teacher motivation. It is common knowledge too that the academic and professional standards of teachers constitute a critical component of the essential learning conditions for achieving the educational goals.

3.0.1 Teacher education

Teacher education acknowledged as an important lever for the quality of school education. Improving the quality of teacher education would help in development of more capable and motivated teachers, which would improve the quality of classroom processes and school education. However, the current teacher-education system has several challenges and limitation. The basic model of the in-service teacher education (INSET) has been of a centralised program design. It is often seen necessary to ‘cover‘ all the teachers in a state every year in teacher training programs, this makes the process focus on reaching training targets, making it supply driven. This model leads to limited interaction amongst participants during training and amongst participants and with Resource Persons (RPs) after training.

Read more..

NCFTE - Issues with current INSET models

The National Curriculum Framework for Teacher Education, 2010 (NCFTE) has identified several issues with INSET. It says, ”An attitude of resignation towards initial teacher education and piecemeal in-service training courses have become an integral part of state provisioning for elementary education. The training of teachers is a major area of concern at present as both pre-service and in-service training of school teachers are extremely inadequate and poorly managed in most states. Pre-service training needs to be improved and differently regulated both in public and private institutions, while systems for in-service training require expansion and major reform that allow for greater flexibility”.

The NCFTE[5] envisions that 'the broad aims of continuing professional development programmes for teachers are to : break out of intellectual isolation and share experiences and

5 http://ncte-india.org/ncte_new/pdf/NCFTE_2010.pdf

insights with others in the field, both teachers and academics working in the area of specific disciplines as well as intellectuals in the immediate and wider society'.

3.0.2 ICT and Teacher Education

In a society that is termed as the 'digital society[6]', educational processes too can be meaningfully impacted by ICT. So far, the significant focus of ICT in education has been on students learning to use few software applications, without much involvement of the teachers, this has made these programs stand-alone. Perhaps the beginning of ICT integration in school education, should be in the area of Teacher Professional Development (TPD).

Digital technologies (popularly known as Information and Communication Technologies, or simply ICT) can provide opportunities for connecting teachers and reducing intellectual isolation. The NCFTE[7] says 'Any effort to strengthen teachers' professional practice must equally respect them as professionals. This includes matters of training in content and approach, how trainings are announced and how they are implemented. Programmes must build on and strengthen the teacher's own identity as a professional teacher and in many cases also establish and nurture the linkage with the academic disciplines of their interest. Programmes that compromise on the professional identity of the teacher and his/her autonomy will be unsustainable in the long run, providing very little psychological motivation for teacher to internalize what they have been 'told' in their practice'. to TPD essential for effectiveness'.

ICT can support participatory models of teacher education. ICT can be used to support self-directed, need based, continuous, peer learning and mentoring based teacher education. The integration of ICT in teaching can help in the enrichment of classroom pedagogies. This tool-kit discusses a model of ICT integration that facilitates these processes.

3.0.3 Teacher learning spaces / forums

The NCFTE[8] advocates for Teacher Learning Centres (TLC's) as a forum for interaction and sharing, which would support Teacher Professional Development (TPD). It says "A TLC would serve as a forum for interaction among teacher trainees and teacher practitioners on issues of developing materials and planning for teaching. Frequent interaction and sharing would help trainees to articulate concerns with clarity and learn from each other's experiences".

ICT can be used to build virtual learning spaces, in which teachers (and teacher educators and student teachers) can share their ideas, experiences and resources for learning, as well as seek support of peers, beyond the constraints of space and time, imposed by physical interactions. These virtual networks can also help support the NCFTE's suggestion that "the broad aims of continuing professional development programmes for teachers are to break out of intellectual isolation and share experiences and insights with others in the

6 https://en.wikipedia.org/wiki/Information_society
7 http://ncte-india.org/ncte_new/pdf/NCFTE_2010.pdf
8 http://ncte-india.org/ncte_new/pdf/NCFTE_2010.pdf

field, both teachers and academics working in the area of specific disciplines as well as intellectuals in the immediate and wider society".

3.0.4 Curricular resources

Material development has been acknowledged as an important component of TPD, which would enhance the availability of local resources for teaching. A recent development in the educational domain has been the rise of Open Educational Resources[9] (OER), with the promise of delivering quality education. An essentially, digital phenomenon, OER seek to leverage the possibilities of digital methods for accessing, creating, modifying and sharing educational content. OER has redefined the copyright regime, stimulating the sharing of content with license to re-use, modify and share or publish.

There is need to promote the integration of ICT in education, to meet the aims of TPD and towards the creation of teaching resources. This toolkit aims to promote a model of TPD, which integrates ICT in the creation, re-purposing and publishing of OER using FOSS applications.

3.0.5 Technological-Pedagogical-Content Knowledge (TPACK) framework

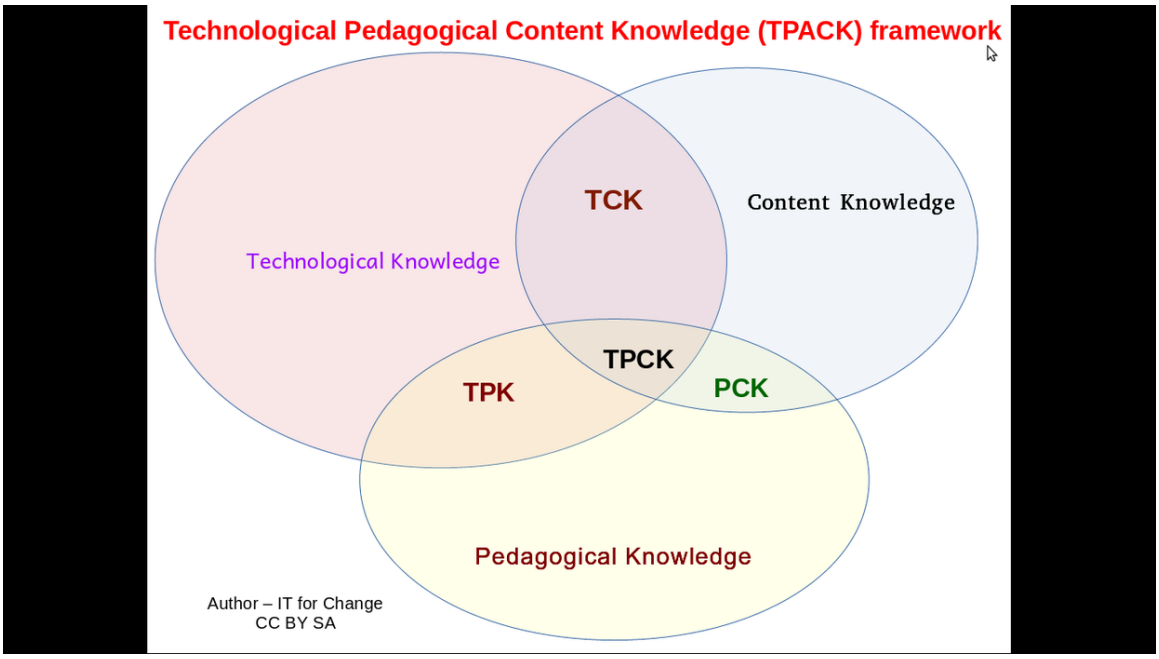

Figure 5 TPACK framework

Implementing the PLC-OER model in government school systems would improve the teacher development and curricular resource development processes and thereby support the national goal of a universal and equitable education system. This model subscribes to the

9 https://en.wikipedia.org/wiki/Open_educational_resources

'Technological-Pedagogical-Content Knowledge (TPACK) framework, which emphasises the integration of technological knowledge, pedagogical knowledge and content knowledge for teacher professional development. Another way of expressing this would be to say that strengthening the technological knowledge of the teacher, should be towards altering the content and pedagogical practices of the teacher, enhancing her content and pedagogical knowledge as well. The integration of ICT must aim at enriching pedagogy and content, to support quality education.

4 PLC-OER model of TPD

A Professional Learning Community Approach for Teacher Development and OER creation - A toolkit[1]

Introduction to the tool-kit[2] **PLC-OER model of TPD** **Planning the PLC-OER program**[3]

__ ***Programmes must build on the principle of creating 'spaces' for sharing of experiences of communities of teachers among themselves, to build stronger shared professional basis of individual experiences and ideas. Giving teachers a space to develop and hear their own voices is of utmost importance.***

- National Curriculum Framework for Teacher Education, 2010 (NCFTE)[4]

Since teacher education is accepted as the most important factor in quality of school education, the first priority for ICT integration in education, should be in teacher education. The aim of such integration should be to achieve the aims of teacher education, and be based on the principles of teacher education, as envisioned in NCFTE and other documents. The tool-kit proposes a model of ICT integrated teacher education in line with NCFTE vision, through building professional learning communities of teachers.

4.0.1 Subject Teacher Forum program - building professional learning communities of teachers

The Centre for Education and Technology, IT for Change (ITfC) designed the Subject Teacher Forum program (STF) in-service teacher education program, in Karnataka and Telangana in partnership with the education departments of both states. The STF focused on building professional learning communities of teachers, using digital methods for e-content creation, subject-teaching and networking. Thus the STF program is a model of '**PLC-OER**' (**Professional Learning Communities** of teachers, developing **Open Educational Resources,** for their own professional development, as well as for subject teaching. The experiences from this program have contributed to the development of the PLC-OER model, which is the subject of this toolkit.

1 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit

2 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/Introduction_to_the_tool-kit

3 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/Planning_the_PLC-OER_program

4 http://ncte-india.org/ncte_new/pdf/NCFTE_2010.pdf

Figure 6 STF workshop

The Karnataka STF[5] (2011-16) developed the capacities of 20,000+ Mathematics, Science, Social Science, English and Kannada teachers across 4,500 government high schools, built the bi-lingual Karnataka Open Educational Resources[6] (KOER) repository and contributed to curriculum revisions and e-learning courses. Teachers have exchanged resources and experiences on the mailing lists and on several mobile phone based learning communities, most deal with academic issues and resources. The academic resources from 150,000+ emails shared in the forums, have been published on the Karnataka Open Educational Resources (KOER) web portal. KOER contains 8,000+ web page teacher created resources and 4,000+ files for Mathematics, Science and Social Science subjects in English and Kannada languages.

In Telangana STF[7] (2015-ongoing), ITfC developed ICT textbook as per NCERT ICT Curriculum and the Telangana Repository of Open Educational Resources[8]. 1,500+ teachers are members of virtual professional networks, learning to integrate ICT for professional development, e-content creation and subject-teaching.

5 http://karnatakaeducation.org.in/KOER/en/index.php/Subject_Teacher_Forum
6 http://karnatakaeducation.org.in/KOER/en/index.php
7 http://troer.telangana.gov.in/OER/index.php/Telangana_ICT_implementation
8 http://troer.telangana.gov.in

4.0.2 Components of the PLC-OER model

The PLC-OER model has the following components (see the graphic provided in this section, which outlines all four components):

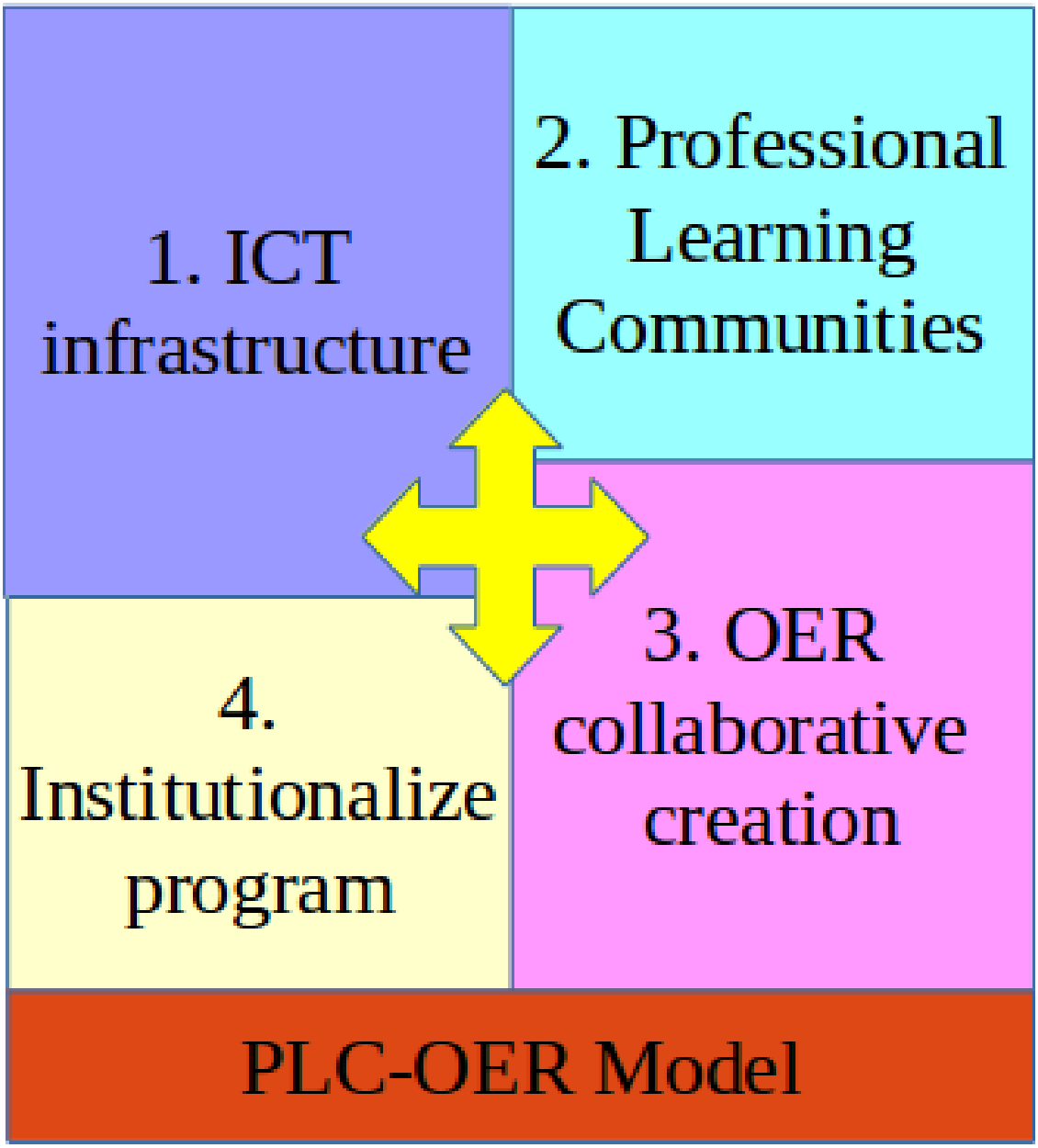

Figure 7 PLC-OER model components

Establishing ICT infrastructure in schools and teacher education institutions.

1. Teacher capacity building to integrate ICT in the following areas
   a) Digital literacy
   b) Using generic and subject based digital tools for creation and revision of Open Educational Resources

   c) Subject teaching
   d) Participating in virtual professional learning communities
2. Development of the state Open Educational Resources repository and creation, revision and curation of Open Educational Resources and publishing on this state repository.
3. Institutionalizing the program, this includes:

1. Embedding the program within the INSET program of the education department
2. Development of student 'text book' and teacher hand book for ICT integration
3. Blended learning courses for teachers

These tool-kit discusses the design and implementation of each of these components.

5 Planning the PLC-OER program

The aim of the PLC program is to support TPD, integrating ICT so as to meet the vision of TPD as discussed in the NCFTE

The PLC program of TPD aims to enrol all teachers working in school education in a state. The vision for TPD needs to encompass every teacher in the school. There is no subject/area, where the teacher will not benefit by participating in virtual professional learning communities, for sharing experiences, resources and learnings. In every area, there is a need for supporting the development of learning materials that can address diverse and local needs, and digital tools could help in this. Every teacher should be a co-owner of the school ICT lab.

5.0.1 Phasing

However, the ICT Infrastructure within the education department will not usually be available to cover large number of teachers. It is very important to build the ICT infrastructure in-house so that it is available whenever required by teachers. Depending on external ICT Labs will not allow this flexibility and will also be expensive. It is better to phase the program over 3-5 years, to include all teachers in the schools. This will support better quality. Hence the program would need to be conceptualized as a multi-year program, since it would not be feasible for all teachers to be enrolled in a year. This will also support the development of capacities for designing and conducting this program over time.

Secondly, it is important to begin with the highest classes in the school system and gradually include lower classes in a phased manner. In Karnataka, where the school system comprises lower primary schools (grades 1 through 5), higher primary schools (grades 1 through 7 or 8) and high schools (grades 8 through 10), the program began with the high schools. The reasons for this are simple - the high schools tend to be fewer and have better overall infrastructure, as well as larger absolute number of teachers. Comparatively, the lower primary schools on the other end tend to be many more in number, spread out in more remote areas, with fewer teachers and poorer overall infrastructure. The support required to maintain ICT infrastructure and scaffold teachers' learning to integrate ICT into their

1 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit
2 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/PLC-OER_model_of_TPD
3 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/Establishing_ICT_infrastructure

work, is of a higher order for the higher and even much more for lower primary schools. Hence, after professional learning communities of high school teachers have been built, higher primary schools could be taken up. The PLCs of high school teachers could in their own geographies, support the PLCs of the higher primary school teachers. Likewise PLCs of higher primary school teachers could in their own geographies, support the lower primary school teachers. PLCs across these types of schools could be created, supporting the development of virtual school complexes over time, which could also link to the teacher support institutions in those geographies to develop the .

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The Education Commission, 1964-66 observed that a school complex ”would have several advantages in the helping to promote educational advances. Firstly, it would break the benumbing isolation under which each school functioned; it would enable a small group of schools working in a neighbourhood to make a cooperative effort to improve standards; and it would enable the state education department to devolve authority to functional levels.” The 1986 National Policy on Education, broadened this concept to 'educational complexes' which would include teacher education institutions and other school support institutions, apart from schools in the geography.

Thirdly, it is important to focus at a time on a few subjects, rather than all. In larger states, it would be better to identify one subject at a time, and build PLCs for those subject teachers. Having a larger number of teachers of one subject being enrolled in the program will provide more traction to the interactions amongst the teachers, than working with smaller number of teachers of different subjects. Working on one subject at a time also puts lesser pressure on schools, as only the teacher(s) teaching that subject would need to pulled out of school.

However, the vision should encompass every teacher in the school. There is no subject/area, where the teacher will not benefit by participating in virtual professional learning communities, for sharing experiences, resources and learnings. In every area, there is a need for supporting the development of learning materials that can address diverse and local needs, and digital tools could help in this. Every teacher should be seen as a co-owner of the school ICT lab.

The sequencing of the program components can vary, based on state and local priorities. Any of these could be could be undertaken as the first step

1. Setting up the PLCs - this enables a large network of practitioners comfortable with ICT integration in TPD and classroom transactions, post which OER, Textbook and OER repository could follow.
2. Building a large-scale collaborative OER creation, revision and sharing model can be initiated after building the PLCs. The group of OER creators can be small to begin and gradually increase by enabling more interested teachers to learn OER creation, revision and sharing/publishing. As a part of this OER program, developing the text book and hand book for classroom transaction; having the text book and hand book can provide a firm basis for the design and implementation of the PLC program of TPD. This component would also include building the state OER repository, which

can support PLC building and OER creation which could feed into the Textbook development.

Karnataka began with PLC and then initiated the OER component. Telangana began with collaborative OER creation and text book development followed by PLC. Each state will need to customise the phasing, of the program based on geography (starting with select districts) and subject (starting with select subjects), depending on contextual factors such as number of schools, teachers, districts, state of ICT Infrastructure, current awareness to ICT etc. In terms of subjects, Mathematics teachers, from our experience, tend to be the most 'technology-savvy' of all subject teachers and Mathematics also tends to be an challenging area requiring greater support, hence it would be a good idea to begin with Mathematics teachers, then expand the program to inclulde Science and Social Science subjects, and continue with languages and other subjects.

In any of these scenarios, the development of blended learning courses should be one of the last components, as it requires a large body of teachers who have digital literacy (which is a PLC outcome) and curricular resources (which is an outcome of the OER and textbook components). Some states have started on-line courses / blended courses without building universal digital literacy in teachers, this is unlikely to be effective.

5.0.2 Perspective plan

Since the STF is likely to be a multi-year program, a perspective plan would be useful to prepare. This plan would discuss the vision of program, identify priorities for the state, recognizing the contexts and challenges in TPD. The plan would also provide direction in terms of the components being prioritised and the subject teachers covered for participation in the PLCs. The plan would also include the phased development of in-house ICT infrastructure, in schools as well as in the teacher education institutions at state, district, block and cluster levels.

The coverage of teachers and the provision of ICT infrastructure can be dovetailed, such that teachers from schools, where the labs are being provided can be included in the teacher education for that year. This can avoid situations where there are labs in schools, whose teachers' digital literacy capacities have not been built, or where teachers are trained, but their schools do not have ICT labs.

Resource - Illustrative Perspective plan[4]

5.0.3 Preparation of Annual Work Plans (AWP) every year

The detailed planning and budgeting for the program would need to be done as part of the AWP processes. Since the program is envisaged as as a part of the regular in-service teacher education of the government, funding would be secured from Central (RMSA/SSA) and state government budgets. The AWP would discuss the specific objectives of the program for the year, investments, risks/challenges and expected outcomes.

4 https://teacher-network.in/OER/index.php/File:Telangana_perspective_plan_April_2016.odt

Resource - Illustrative AWP

The PLC program envisions building ICT integration capacities in all teachers in the school system. As mentioned, this will take a few years time, since teachers can be covered only in a phased manner. After all teachers are enrolled into the PLCs, the method of the teacher training, can be continued, with focus of the training changing, as per priorities. Essentially, the PLC approach requires access to an ICT lab, where teachers can access resources pertaining to any topic. Secondly, teachers learn digital tools and methods which will help the deepen their knowledge or transact or create curricular resources for that topic. Thirdly teachers become part of virtual networks, which aim at continuing the learning on that topic, beyond the workshop.

This means that after 'subject teacher forums' are established and all teachers are enrolled in their respective subject forums, the same model can be used to build PLCs on other important issues such as gender, adolescent education, vocational education etc. Thus PLC can be seen as a method of in-service training, into which different areas of knowledge/ learning can be incorporated. This model will allow for richer learning during the face-to-face workshops by allowing access to the web during these interactions. It will also allow continuity of learning after the workshops are completed. By ensuring a teacher:computer ratio of 1:1, the number of teachers in any workshop is kept to a manageable number which can allow for more meaningful learning.

Thus the PLC program can continue indefinitely as a part of the in-service teacher education program of the state.

5.0.4 Establishing state and district level design and implementation teams

The PLC program requires a robust structure, at state and district levels, to provide academic and technological support to the teachers, after the workshops, for co-designing and implementing the program. The groups can comprise teachers and teacher educators.

At the state level, a **steering committee** needs to be established for the program. It could have sub-groups for the PLC and OER components. The convenor/chair of the committee can be the head of institution of teacher education at the state levels. The steering group will oversee the set-up of the infrastructure, teacher training as well as curriculum and syllabus aspects. The steering group can have different sub-groups for review of syllabus and curricular resource materials, designing and development of teacher training programmes as well as infrastructure maintenance and support. The steering group could include members from SCERT, partner organisations implementing the ICT programmes as well as from academic and teacher training institutions.

A second component would be the **Technology support team** at the state and district levels, this will need to be created from the teachers, who are interested in developing technology skills and are trained on technology maintenance and support. The second component was part of the Assam STF, where teachers are much less exposed to ICT, but not in Karnataka, where most teachers have had some exposure to ICTs. This component will be very useful to sustain ICT use, specially where the uptake of ICT is poor.

At the district level, **resource groups** for PLC and OER components need to be established, this would be third component of the program structure. These groups can be formed from the Master Resource Persons for each subject. The responsibility of this team is to provide techno-pedagogical support to the other teachers in the district.

Check list for identification of teachers/teacher educators: Teachers and teacher educators can be enrolled into the state and district resource groups, using some of parameters listed below:

1. Subject knowledge
2. Interest in learning ICT (expertise in ICT is not required)
3. Interest in being a teacher educator / faculty in the workshops
4. Experience in facilitating teacher education programs / workshops

In Karnataka and in Telangana, most of the district teams comprise of teachers. Very few teacher educators are members. This is because, the program has focused on high school teachers and teachers as practitioners tend to be more comfortable in integrating ICT for subject teaching and for resource creation, as compared to teacher educators from DIETs and CTEs.

The department should also identify community organizations promoting free and open technologies at state and district levels and encourage their support to teachers in adopting FOSS tools in schools. In Kerala, the NGO SPACE provided support to the department in supporting teachers adopt FOSS and initially provided the custom distributions of the FOSS platform and applications for their IT@Schools program. In Karnataka and Telangana too, not for profit organizations including the Free Software Foundation, Free Software Movement of India have participated and supported ITfC in the teacher training workshops and also subsequent implementation in schools.

5.0.5 Challenges

The preparation of a perspective plan is necessary to provide a continuity of thought and action with respect to the program. However, there is a high probability of changing priorities, including due to changes in the role of senior officials in the department. This may lead to the program not proceeding as per the perspective plan, with short or longer disruptions likely. Nevertheless, a perspective plan will provide a sense of direction to the program, and progress over time can be assessed with respect to this plan.

6 Establishing ICT infrastructure

The ICT infrastructure component has two components - establishing teacher training ICT labs in teacher education institutions at state and district levels and establishing labs in schools.

6.0.1 ICT Lab as integral infrastructure in the school / teacher education institution

It is essential to establish ICT infrastructure in-house, so that the access to the infrastructure and use is not constrained or limited. In the BOOT model, the ICT lab is owned by an external vendor, who has a vested interest in keeping its use minimal (to extend life of the infrastructure) and in not expanding the assets in the lab (to keep running costs low). In ICT@School programs in most states, where the BOOT model has been adopted, the actual use of the ICT equipment by teachers has been low. At the end of the BOOT period, the schools have not been able to successfully take over the lab, which was the original intention. Given that during the BOOT period, the infrastructure is usually not renewed or upgraded, the assets handed over at the end of the period usually have very low usability.

In contrast, Kerala, which adopted an 'in-house[4]' model instead of the BOOT model (from 2002), has seen the ICT labs maintained well by the schools and in many cases, the schools have managed to get support of the local community and from philanthropies and other donors, to enhance and upgrade the assets in the lab. Often, community members are keen that their children should benefit from digital literacy and can provide donations to the school to increase the provision of devices in the school ICT lab.

It is also essential to establish ICT infrastructure for teacher training within the DIETs and other teacher education institutions in the state, so that these are available without constraints for use in the pre-service and in-service teacher education programs. In Karnataka and Telangana, the availability of ICT Labs in the DIETs supported the PLC program.

1 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit
2 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/Planning_the_PLC-OER_program
3 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/Building_Professional_Learning_Communities
4 http://itforchange.net/policy-brief-%E2%80%93-icts-education-outsourced-versus-integrated-approach

Relying on external providers of ICT Labs whether from private companies or from (government or private) colleges tends to be both expensive as well as make its availability unreliable. The Ministry of Human Resources Development (MHRD[5]), Government of India has support for the establishment of ICT labs in teacher education institutions (DIETs, CTEs, IASE's and SCERT's) as a part of its program of Teacher Education[6]. This support can be used to set-up as well as maintain ICT labs in these institutions.

Hence while maintenance could be outsourced, ICT infrastructure should be treated as core education infrastructure, and its ownership should be with the institution.

6.0.2 Technology infrastructure in schools

An ICT Lab needs to be seen as a part of the basic infrastructure of the school, to provide opportunities for teachers and students to integrate ICT for their learning. Providing adequate infrastructure that will allow access to students and teachers to create and learn using ICT is necessary. Desktop computers or laptops are preferred hardware as these will support resources to be developed using many applications. Only FOSS applications should be used, in line with National ICT Policy and National ICT Curriculum of NCERT. This has been the case in both Karnataka and in Telangana. The advantages of a FOSS environment are listed separately.

The setting up of an ICT Lab in the school requires initial investment for creating the lab covering civil, electrical works and furniture. It is suggested to keep wiring to the minimum to reduce maintenance costs. Wireless LAN can be set-up to avoid traditional LAN with wiring. Wiring will be required for providing electricity to each lab. Dependable power supply is an important criterion for success of the program. Solar power costs are rapidly reducing and this should become a model to consider seriously and invest in. The scale of electrifying schools will allow further reduction of solar energy costs due to economies of scale.

The lab requires furniture to allow for the learners to use the devices comfortably and to allow the devices to connect to power and internet sources. Securing and storing the devices safely and providing ‘charging’ access for devices with batteries is another requirement.

Hybrid configuration

ICT devices - desktop computers, laptops, tablets and mobile phones are in a spectrum of capabilities with the initial costs and recurring costs (mainly power consumption) reduce from the first to the last, and so do the processing capabilities of the devices. Hence, while desktop computers have been the mainstay of ICT infrastructure in schools, with the increasing use and popularity of the mobile phone, it may be useful to think of a hybrid set-up with desktops, laptops, tablets and mobile phones.

Intensive learner activities will need students to share computers, supporting collaborative learning; but when they are accessing information, each can have access to one access device

5 http://mhrd.gov.in
6 http://teindia.nic.in/Default.aspx

like a tablet or a phone. However, a hybrid environment would put additional pressure on the maintenance front, since different kinds of devices would have different maintenance issues/ requirement. Hence, the extent of hybridisation can be a function of the level of sophistication of use in the school / institution. Where the sophistication is very low (first time access to ICT), providing one kind of devices may make the maintenance simpler / easier.

Server

In all cases, the lab must have a 'software and content server' which provides services to all the other devices including file storage and access, internet connectivity etc. CIET, NCERT is developing a school server using the components of a normal desktop computer CPU, which can provide the services mentioned. There are also simpler computing devices such as the Raspberry PI, which could be considered by more sophisticated environments, these can act as servers or as regular clients.

Cloud architecture is becoming popular, where the software and data are remotely hosted. Cloud architecture enables easier management and maintenance, however it has two demerits – the need for connectivity and reduction in the local location and ownership of the data and software components. Hence, local hosting on of the software and data the school / institutional server should be preferred, and made available in any case.

School MIS (Management Information System) and PIS (People Information systems) for supporting the regular transactions of the school and providing information to parents and community members is to be done using the school server, using simple available free software tools. Kerala has customized the free software 'Fedora' and adopted 'Sampoorna[7]' in all government schools in the state. The school server should also house the OER repository for providing content to support learning opportunities for teachers and students. Communicating with parents and other stakeholders using relevant software tools is another school requirement.

Peripherals

Apart from the computers and hybrid devices, each lab should have at least one digital camera, a printer and a web cam if required. The peripherals would be available to all devices through the server. If the lab has desktops, then power back is essential, consisting of UPS and battery.

Software

This note assumes the use of FOSS and hence does not provide for licence fees towards proprietary software. It is possible that applications will need to be developed for many new areas. These should be purchased by the government and licensed as FOSS, so that there are no constraints on its distribution.

7 https://en.wikipedia.org/wiki/Sampoorna

The Education Technology wing of the SCERT needs to prepare a 'custom distribution' of software applications for use in the school and teacher training labs. This will consist of a free and open operating system, to which other required software applications (both generic software tools and subject specific tools) can be 'added'. Secondly, the language software packages for all languages taught in schools, can be added to this distribution.

Custom distribution of Ubuntu GNU/Linux, including all the software applications listed in the tables at the end of this section have been prepared by IT for Change for Karnataka, Assam, Andhra Pradesh and Telangana. Since the custom distribution consists of only FOSS tools, it can be distributed freely through DVD-ROMs and pen-drives and other storage devices freely, without any constraints. In Telangana, the State Institute of Education Technology (SIET) has burnt DVD-ROMs with the custom distribution and shared a copy with each teacher attending the teacher professional development workshops. Such free distribution is not possible in the case of proprietary software.

> Resource - Custom distribution of Ubuntu GNU/Linux
> (http://tinyurl.com/Ubuntu16-04-ISO)

Connectivity

It is essential to look at learning with and through ICT, not only as interacting with a device, but as learners interacting with one another and with the world wide web. Hence, connecting the devices to one another in the lab and to the internet is essential. The former can be by enabling Wi-Fi functionality in the school server, so that all devices can connect to the server and to one another through the server itself, avoiding the internet for this. In addition, through the server, the devices can also connect to the internet. It is recommended to connect through the server, for keeping a track of the actual use of connectivity. Also, as a practice, if the regularly used/required content is stored in the server and accessed locally, it will reduce the need for internet connectivity. For this, every state should consider the data that will be provided as a part of such school content repository.

> Resource - Detailed guidelines for managing the ICT lab at the school level are available in the Telangana ICT teacher handbook[8]

8 https://teacher-network.in/OER/index.php/ICT_teacher_handbook/School_level_implementation_guidelines

Figure 8 Teacher using a personal device to teach students TurtleArt application, for creating patterns, using algorithms

6.0.3 No teacher left behind

It is important to encourage every teacher to also have access to a computer, to support professional development. Having anywhere and any time access to a computer will provide more opportunities for development to teachers. The department should enable teachers to acquire personal digital devices through attractive loan schemes to allow teachers to buy personal digital devices such as laptops, tablets, e-book readers etc. In Kerala, the department negotiated with vendors, on behalf of the teacher community, to reduce the price significantly on select laptop models. In Goa, the department provided interest-free loans to teachers to purchase personal laptops.

Case - Goa laptop loan scheme[9]

One benefit from teachers having own devices is that many more teachers would integrate ICT in their teaching, using their laptop for demonstrations in the classroom, (apart from using the ICT lab in the school). There are many instances of this from the Karnataka Subject Teacher Forum program.

Similarly, schools should be encouraged to purchase ICT devices for use of students and teachers, from their internal funds, funds received from the government and other public institutions, as well as approach local philanthropies, donors and community institutions to

9 http://education.goa.gov.in/schemes/schemes-planning.pdf

support the ICT lab, in terms of acquiring devices or their maintenance. In Karnataka, the department issued a circular that schools could use existing untied school funds as well as the RMSA school grant to purchase laptop and projector for use by teachers. This circular enabled many schools to purchase a laptop for the common use of all teachers, to prepare and demonstrate ICT integrated lessons in their teaching.

6.0.4 Technology infrastructure at teacher education institutions at state and district levels

The education department should provide for adequate infrastructure for training at the state and district level. Having district level labs (in the DIETs and CTEs) will also allow the state to structure and implement training programmes, based on the needs and requirements throughout the academic year.

Every teacher education institution requires an ICT lab to support ICT integrated teacher education. It is important to envisage the use of ICT in all teacher education programs, not only in ICT teacher training. In every teacher training program, there must be access to an ICT Lab for teachers and teacher educators to use, for activities connected to the training itself (accessing resources, interacting with one another during the program, writing and submitting assignments digitally etc.). Each institutional ICT lab should have at least 20 desktops/ laptops.

There is a need to also integrate ICT across teacher education system, so that educators working in teacher education institutions are able to use ICT meaningfully in pre-service and in-service teacher education. Making available a functioning ICT Lab in every teacher education institution can support the integration of ICT in both pre-service and in-service teacher education. In Karnataka and in Telangana, this has been done through the regular in-service teacher education programs of the government.

ICT also has an huge potential in strengthening education administration, by improving efficiencies as well as transparency and participation in the management of the system at school to state levels. Hence, there is a need to provide a personal digital device to each teacher, teacher educator and education administrator. Providing a personal device is necessary to allow the person to create and store digital materials/content and use this subsequently, as a personal digital library. The provision of a personal device also allows for use whenever required. Teacher educators should be encouraged (through interest free loans) to purchase their own laptops / devices (BYOD), which they could use for their own professional development as well as in teaching and teacher support. The department must prioritise the provision of a laptop to every staff member and insist on its use for academic and administrative purposes.

6.0.5 Sustainability

ICT programs in schools often have not sustained beyond an initial period where the infrastructure has been provided / developed. The design of ICT programs must consciously aim for sustainability, where the schools and other institutions can continue the integration of ICT beyond the initial investment period.

1. Developing in-house capacities of teachers and teacher educators to appropriate ICTs for their work can support the sustainable use of ICT, freed from vendor lock-ins.
2. Using ICT to build peer networks of teachers can support continued learning and professional development and serve as a sustainable method of TPD as well as sustain the ICT implementation.
3. Making the school and teachers owners of the ICT infrastructure would also support the sustainability of the program. As evidenced in Kerala, when the teachers own the program and the infrastructure, in many cases, they take special care of the assets, not only in terms of maintenance, but also its renewal and enhancement.
4. The use of free and open technologies also avoids vendor lock-ins, these lock-ins can affect continuity of the program, if the vendor stops their support. FOSS applications can be periodically upgraded without licensing constraints, which would enable the use of more relevant applications or versions.

6.0.6 Free and open technology architecture

The 'public' nature of education aligns strongly with free and open ICT architectures. It is recommended by the National ICT Policy on education, 2012[10] that the ICT implementation in school education use free and open technologies, including FOSS (Free and Open Source Software) and OER (Open Educational Resources).

The National Policy on ICT in School Education, 2012 recommends a free and open technology environment and seeks the creation of a resource rich environment; yet, many states still use proprietary software and content in their ICT programs in schools. In the proprietary environment, teachers cannot legally copy or share the digital resources and this can impact their agency. A free and open environment, on the other hand provides the teachers the right to make copies, change and re-distribute the resources. Following the National Policy on ICT in School Education and the successful implementation of ICT programs in Kerala and few other states, it is suitable for all states to explore moving away from proprietary technology environments to free and open environments (for both content and software).

The public ownership of ICT infrastructure and resources can enable universal access and equitable participation. Since the government school system is huge, its choice of free and open technologies could support the building of the ecosystem for free and open technologies as well. This is seen in the IT@Schools[11] program of Kerala.

Unlike their proprietary equivalents, both FOSS and OER permit free use, re-use, revision and re-distribution, creating a sharing environment. Promoting FOSS and OER can help create a rich digital learning environment. It also reduces or avoids software piracy, which is an unethical and illegal but not uncommon practice. ICT resources that are free and open, can be freely accessed, shared, modified and re-distributed. The use of FOSS software applications is essential to support universal access to software. In addition, since FOSS allow modification by all, this allows possibilities for interactions between teacher communities

10 http://itforchange.net/sites/default/files/ITfC/revised_policy+document+ofICT.pdf
11 https://itschool.gov.in/

and free software communities and helps teachers and learners move from being 'consumers' of ICT to participants in its creation, enrichment and sharing.

In the area of ICT, the 'private' often becomes 'proprietary' by which the owner of the ICT resource becomes the sole arbiter for its design and use, constraining and limiting the role of teachers, learners and the education system, through legal and technological constraints. This affects ICT resource distribution and use, impoverishing the digital environment.

Benefits from FOSS

The specific benefits of using FOSS platforms and applications in the PLC-OER program are listed below

1. Since FOSS is **freely shareable, it can be downloaded free of cost**. It can be installed on all the computers in the ICT lab without restriction or needing to pay license fees to vendors. Teachers and students can take the software and install on their home computers, at no cost.
2. A FOSS operating system like GNU/Linux allows 'custom distribution'. This means all the required software like Office suite, web browser, educational software applications can be bundled with the GNU/Linux operating system and **can be installed on the computer at one time.** On proprietary operating system, such as Microsoft Windows, each software has to be separately installed, which makes it cumbersome and complex.
3. The **GNU/Linux FOSS operating system is virus-resistant**. This avoids any need to procure anti-virus software and also avoids downtime when virus affected computers have to be formatted. This saves time and effort.
4. Ubuntu GNU/Linux used in both the Karnataka and Telangana programs is customised in Kannada, Telugu and many Indian languages. **Ubuntu GNU/Linux has the IBUS software in-built which allows us to type in all major Indian languages, so it can be used in our schools for other languages also**. Note that Ubuntu uses UNICODE standard for fonts, which is accepted internationally and also by Government of India policy.
5. There are numerous free and open **vocational educational tools** for **desktop publishing, video editing, animation etc.** which can be bundled with the custom distribution.
6. The use of FOSS reduces dependence on software vendors and avoids vendor lock-ins, which can be detrimental to the continued use of ICT in schools.
7. Teachers and students can study the software and customise additional software packages for their own use. They can also share the tools with others.
8. Government of India has issued the ['open standards in e-Governance'[12]] policy in November 2010, which requires government departments to use only open standards. The OpenOffice document standard (ODF) has been notified under this policy, while the MS Office format .doc is not open and hence not notified under thus policy.
9. The use of appropriate generic and subject specific FOSS applications can help teachers create OER in many formats, to create a resource rich learning environment.

12 `http://egovstandards.gov.in/sites/default/files/PolicyonOpenStandardsfore-Governance.pdf`

10. Teachers can make the philosophical connection between free education and free software. Just as a government funded public education system is necessary for universal education, free software is required for universal access to, and participation in the digital world. This understanding can facilitate a positive mindset of 'our schools', 'our software', encouraging ICT adoption.
11. FOSS is available in all subjects, which allows us to integrate computer into regular teaching learning. The table below provides some popular FOSS subject tools.

Subject	**FOSS application**	**Description**
SCIENCE	Kalzium	Kalzium shows the periodic table and the properties of elements. It is an encyclopedia, explaining states of matter, evolution of elements. Basic equations can be balanced using this tool
	KStars	Desktop planetarium-Astronomy with over 130000 stars, planets and other galactic bodies
	Stellarium	This is another desktop planetarium software that shows exactly what you see when you look up at the stars
	PhET	Interactive simulations of physical phenomena which can demonstrate scientific experiments
	KTechLab	Can be used to build your own circuits and explain various components
MATHS	Geogebra	An algebra and geometry package providing for both graphical and algebraic input, very versatile to create lesson plans and resources for maths learning
	Tux Math	A fun game through which children can practise their addition, subtraction, multiplication and division
	KBruch	This tool can be used to explain fractions as well as for the children to practice arithmetic problems
LOGIC	TurtleBlocks	TurtleBlocks can be used to create exercises to learn logic.
History	Timeline	Time line can be used to represent events across time to create a simple presentation
Geography	KGeography	Can be used to teach political geography
	Marble	This acts as a dynamic desktop atlas to explain physical geography
ENGLISH	KHangman	Guess the correct work with a certain number of guesses allowed
	KAnagramIndicAnangram	Unscramble the word for vocabulary development. IndicAnagram supports complex words in Hindi, Telugu and Kannada

	KLettres	Identify the alphabets by recognising the sound
	Tux Typing	Tux Typing" is an educational typing tutor

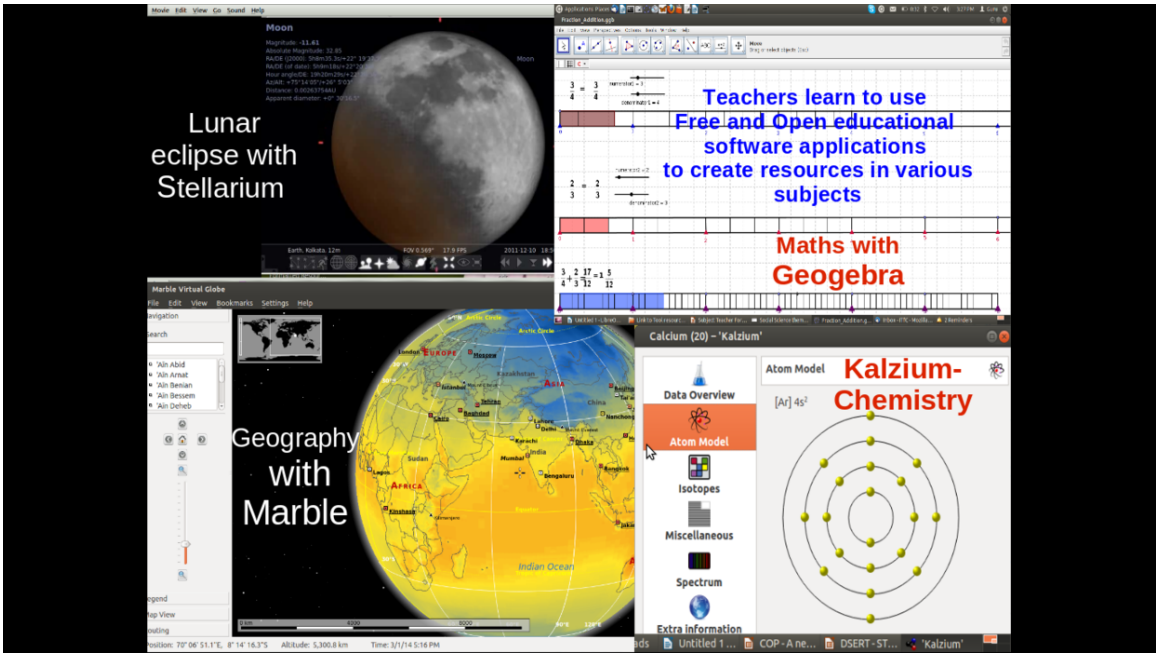

Figure 9 Free and Open Source educational software applications, which can be 'bundled' with GNU/Linux operating system

In addition, the generic software applications used for creating resources in text, image, animation, audio and video formats are available as FOSS tools. Including these in the school software environment provides much greater opportunities to teachers and students for both digital literacy as well as for creating resources for teaching-learning. Some of these tools (they are too numerous to list) are provided in table below:

Area	**FOSS**	**Popular proprietary Software**
Operating system	Ubuntu GNU-Linux / Bhartiya Open Source System (from CDAC)	Microsoft Windows
Office Applications (text editing, numeric editing and presenting)	Open Office / LibreOffice (text editor, spreadsheet, presentation, database, drawing tools)	Microsoft Office
Image editor	GIMP, Tux Paint	
Animation editor	Tux Paint, Tupi, Peek	
Audio editor	Audacity	
Screen casting tool (creating videos)	Kazam, RecordMyDesktop	
Concept map editor	Freeplane, Freemind	
Email client	Mozilla Thunderbird / Evolution	Microsoft Outlook
Internet Browser	Mozilla Firefox / Chromium	Internet Explorer / Microsoft Edge / Google Chrome
Vocational Educational tools		
Desktop Publishing	Scribus, Inkscape	Page Maker, Corel Draw
Video editing	Kdenlinve, Openshot, PiTiVi	Adobe Premier, Final Cut Pro
Animation	Blender, Synfig studio	Adobe Macromedia
On-line FOSS platforms		
Web platform for OER publishing	MediaWiki	
e-learning courses Learning Management System (LMS)	Moodle	
Digital resources authoring and publishing	H5P	

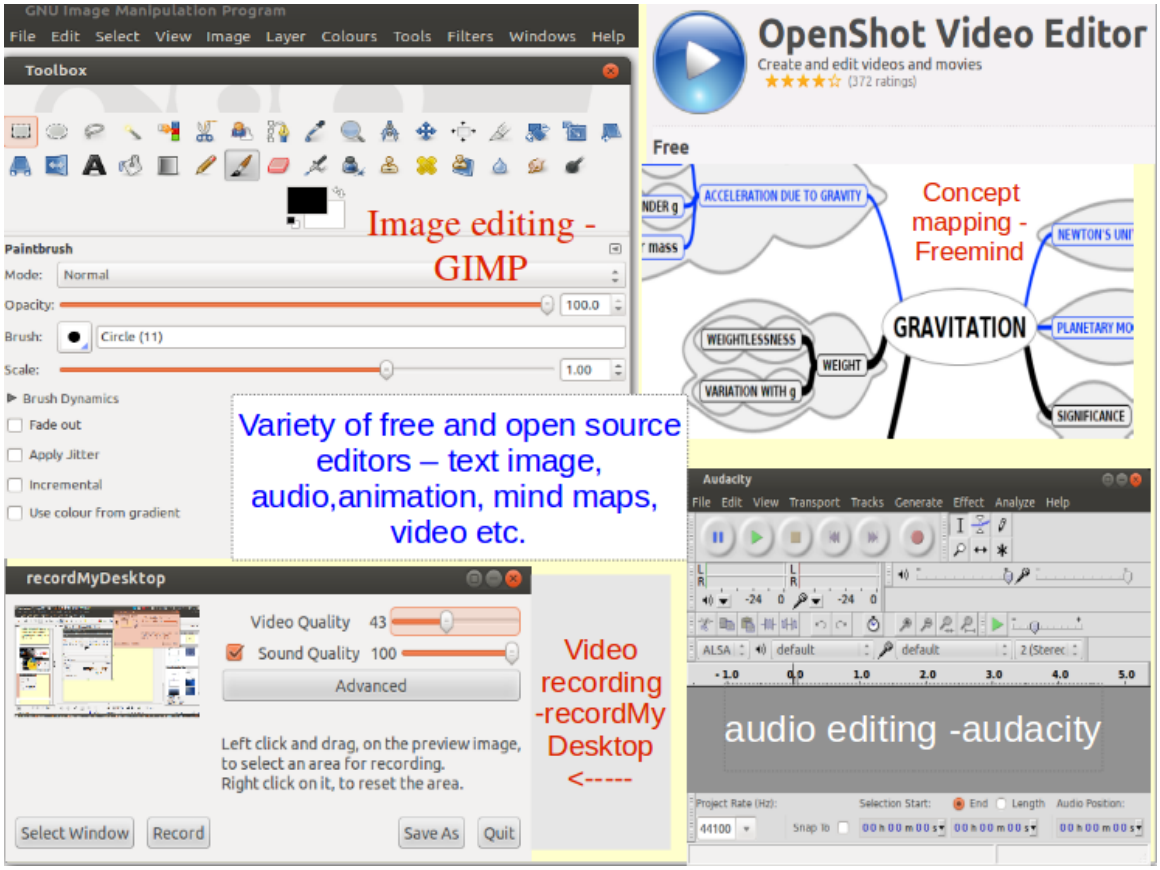

Figure 10 FOSS generic resource creation software applications

Resource - For more information on how teachers can use these tools, please refer to the on-line user manual[13].

6.0.7 Challenges

Maintenance and repair of ICT infrastructure

Maintenance support for ICT infrastructure can be difficult, specially in rural and remote areas. One of the most common complaints in past programs has been the delays in getting non-working devices repaired. One solution for this challenge is to build teacher capacities to maintain and configure hardware and software in the labs. Kerala has done this effectively. Kerala has also created 'mobile hardware health clinics' in which a group of teachers travel from school to school to check the infrastructure and repair non-working devices. Note that in most cases, 'repair' is nothing but 'replacing' the dysfunctional component, and not actually making it work. So if teachers are trained to isolate and identify non-working components that cause the computer to fail, and provided the spares, they could

13 https://teacher-network.in/OER/index.php/Explore_an_application

maintain the labs. In Assam and in Telangana, the department has trained technical support personnel on maintenance of the hardware and software used in the schools, to create 'District Technology Support Groups' (DTSG) which will provide support to the teachers and the schools.

Renewal of ICT infrastructure

ICT infrastructure tends to be relatively fragile. A blackboard, once installed in a classroom has an indefinite life. However a computer has a short life and can even fail earlier due to failure of any of its components. Electronic equipment is susceptible to failure due to electricity voltage fluctuations, dust, heat - these are quite common Indian conditions. However, sometimes departments seem to assume that ICT infrastructure has a long life, akin to blackboards! For instance, in the BOOT model of ICT programs, at the end of the BOOT period (typically five years), the vendor be handing over ICT infrastructure which would be either dysfunctional or in its last legs. It is extremely difficult for the school to continue the program after this BOOT period. Secondly, in the ICT program, once a school is provided ICT infrastructure, it is 'ticked off' as being 'provided for' in perpetuity. Whereas after 5 years or so, the devices provided would stop being functional and the school would require a new lot of computers.

Schools should be encouraged to tap into different sources for the renewal of computers in their lab. In Kerala, teachers have been able to source a variety of funds, including from the panchayats, community, NGOs, CSR funds to support the renewal of their lab. Once the lab is seen by the school as its 'own asset', it can motivate some of the teachers to make efforts to maintain and enhance the infrastructure, independent of department support.

7 Building Professional Learning Communities

A Professional Learning Community Approach for Teacher Development and OER creation - A toolkit[1]
Establishing ICT infrastructure[2] **Building Professional Learning Communities** **Developing capabilities for OER creation**[3]

7.0.1 Teacher preparation

While success of ICT implementation will depend on many inter-related factors (provision of ICT infrastructure, basic infrastructure, teacher preparation and curriculum), perhaps the most important of all is teacher preparation. Without the required teacher preparation, providing infrastructure or specifying ICT integration through the syllabus would not be effective. However, the weakest component of ICT implementation in school education, has been the inadequate and sometimes irrelevant preparation of teachers to understand the use of ICT for their own professional development and for use in teaching.

Broader digital literacy, not teaching few proprietary applications

One problem with past teacher training has been a predominant focus on teaching the use of few popular proprietary software applications. Instead, the program needs to focus on understanding the nature of the ICT (digital literacy1), use of subject teaching related software tools, accessing web resources, encouraging teachers to create digital resources using a wide variety of (free and open source) authoring tools etc.

Secondly, as world becomes more complex, teacher education needs to prepare the teacher and the learner to be capable of adapting to new environments and tackle new challenge. Being able to develop one's capabilities is much more important than content knowledge, and the focus of ICT integration for TPD should focus on capability development and not merely on sharing or supplying digital content. A universal program of teacher education on these aspects would empower teachers to become comfortable and competent in using ICT for their own development, creation of digital resources and in subject teaching.

It is necessary to envisage this training as a part of the regular in-service teacher education program and not as a stand-alone effort. All state governments prepare their teacher edu-

1 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit

2 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/Establishing_ICT_infrastructure

3 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/Developing_capabilities_for_OER_creation

cation plans for the next academic year, with budgetary support from the state government along with that of the central government through the SSA and RMSA programs.

Based on the TPACK framework, digital literacy would be subsumed as part of the content (subject) and pedagogy related teacher education planned for the teachers.

Need based TPD

The program to build teachers capacity to integrate ICT for their TPD and practice, can also support the broader reform of in-service teacher education. The NCFTE says ”All programmes must find acceptance of their aims with the teachers’ group concerned, regarding whether they need such a programme and why they are to attend it. The principle of choice of programmes to attend, based on teacher’s own assessment of what he/she needs or is advised based on some valid assessment of professional requirement, would provide a sound basis for in-service programmes, especially those that are of a long duration and which seek to impact practice. One size cannot fit all”.

This can only happen if there are spaces available for teachers to voice their needs and aspirations, where they can also discuss with teacher educators, the scope of professional development programs. Such spaces are possible to be created as a part of the virtual networks of teachers. These spaces can also be used by teachers to frankly share their feedback and comments on the programs they have been a part of.

Continuous learning and mentoring

By building virtual networks, the program supports interactions amongst teachers for continuous learning. Teachers can seek help for their difficulties as well as for the broader professional development needs and their senior, more knowledgeable colleagues could support them over these networks. Since this operates on 'as and when required' basis, it can be most useful.

7.0.2 Implementing the program

Based on the perspective plan and the AWP, the program would be implemented in the selected geographies and for the targeted group of teachers. The agenda of the teacher education workshops would need to be prepared, focusing on digital literacy, learning to use generic software applications as well as subject specific software tools. The agenda preparation should needs to be designed carefully, the National ICT Curriculum NCERT, 2013 should be referred in this process. Digital literacy (DL) often is wrongly conflated with expertise in specific software applications and platforms. Digital literacy MUST enable the teacher to explore DTs with a critical perspective, which means being aware that DTs can be useful or useless or even harmful and hence need to be carefully chosen/designed for incorporating into practice, and also being aware of the larger implications of DTs on society - on institutions, governments, markets, media, communities etc - both the positive and negative implications. It is important that digital literacy should move the teacher from being a 'consumer' of DTs - a mere user of applications, to an informed and critical 'citizen' who can decide if, when, how to use DTs and on what terms, and also seek out design of

DTs that meet her needs and priorities. This is also necessary for meaningful design of the program agenda.

Apart from digital literacy, the program agenda would include learning digital methods (generic resource creation applications, subject specific applications, web tools and web resources) to create OER, for subject teaching and networking with peers.

Participants will learn to use digital methods to create resources. The training resources (digital format) will be provided through a website, to encourage participants to refer to them on-line, physical copies should not be provided. Participants will have internet access throughout the workshop, hence can download the resources to their own computers (or pen drives). All participants will also get a copy of the software applications covered in the workshop and they will learn how to install the same on their own computers and school computers.

Resource - Workshop agenda[4]

The program can use the cascade model of teacher education, in which select group of teachers are trained to become 'Resource Persons' (RPs). These RPs in turn will conduct similar programs for their colleagues in their geographies.

Blended cascade

Read more..

The cascade model of in-service teacher training has been criticised as being ineffective. One drawback is 'cascade dilution' where the the quality of the program to develop RPs is not replicated in the cascade workshops, since the RPs would not have the same depth of understanding of the training contents, as their faculty who are usually experts in that area. The cascade dilution problem can be mitigated by using a 'blended cascade' model, wherein, the RPs continue to be in touch with one another, and with their faculty, even after their own workshops. This continued networking has two benefits - the faculty can continue to guide the RPs subsequently and help them to enhance the quality of the cascade workshops. The RPs can also be in touch with faculty and with one another, to solve any doubts, questions that they may have. In addition, some of the key aspects of the cascade workshop can be captured (by way of text, image, audio and video enabled workshop reports), which can be shared on the virtual networks for peer learning and support.

4 http://troer.telangana.gov.in/OER/index.php/Telangana_Science_STF_SRP_Workshop_April_2017#Agenda_for_the_workshop

State level workshops - Building the pool of RPs for each subject area

Figure 11 Karnataka STF MRP workshop, Bengaluru South DIET, 2013

The PLC program begins with the design and conducting of the workshops to create RPs for each subject area (Mathematics, Science, Social Science, Language etc.). These workshops would need to be facilitated by faculty / experts identified by the department. These workshops would be typically conducted in ICT Labs set-up at the state capital / head quarters. The agenda would include enrolling the participants in the state-wide PLCs. The participants would continue their interactions on these virtual networks.

Resource - Illustrative agenda for a RP workshop - Mathematics[5] and Science[6]

5 http://troer.telangana.gov.in/OER/index.php/Telangana_Mathematics_STF_SRP_Workshop_April_2017#Agenda_for_the_workshop

6 http://troer.telangana.gov.in/OER/index.php/Telangana_Science_STF_SRP_Workshop_April_2017#Agenda_for_the_workshop

Regional / district workshops - Blended cascade program of teacher development, for each subject area

The RPs would subsequently facilitate workshops at regional / district levels to train their peers, in the regional / district ICT Labs. The agenda for these workshops would be on the lines of the state workshops, but would the actual transaction would need to be tweaked by the RPs, based on the profile of the participants. It would be useful to invite teachers are seen to be more interested and able to participate in this program first, this would help strengthen the training program and the RPs. If it is possible, the first few workshops could even be by 'application' where interested teachers are asked to apply to participate in the program. Over time, in a phased manner, all teachers must participate in the program, and be enrolled in the state-wide PLCs. In addition, the participants may also create district virtual groups and enrol themselves in these. Teachers can form part of different virtual networks, each with its own aim, scope and geography covered.

Technology Support Group (TSG)

There is a need to build a eco-system of ICT integration in schools across the state, to support teachers. This is even more required in the case of FOSS. There is initial non-familiarity with FOSS platforms and applications and this can become an inhibiting factor for the program.

Suitable persons from each district need to be identified who can form part of the 'District Technology Support Group" (DTSG). In some states, these could be technology team members at the district SSA/RMSA offices. In states where no such technology team members are available, interested teachers (there are likely to be few teachers who are keen to learn ICT and become resource persons to help other teachers) will need to be enrolled into these DTSGs.

Similar to the Subject RPs, workshops would be designed and conducted to train the state RPs for the DTSG. These RPs would conduct workshops to train 5-20 people in each district to form the DTSG for that district, this number is dependant on the overall number of schools and teachers in the district.

School leaders professional learning community

Similar to the subject-wise teacher PLCs, the Head Teachers would also participate in similar program, which would focus on the area of school leadership and development. In addition, the agenda for this program would include a broad orientation of the digital methods that other teachers have learnt, the maintenance of the school ICT Labs, implementation of the program at the school level. Head Teacher PLCs are a valuable space for Head Teachers to discuss administrative challenges that they face, and with facilitation, these forums could also focus on academic issues and aspects such as pedagogical leadership.

Workshop logistics

The number of days in a workshop should not be less than 5 since this is the initial period of immersion necessary to build basic capacities and confidence. Periods larger than a week can also cause fatigue. In the case of the RPs workshops, it is useful to have 2 sessions of 5-6 days each. The second session can be held after a gap of 2-3 weeks after the first one, so that the RPs can use the interim period for practising their learning, reading additional resources and come with their questions and suggestions.

It is essential that the teacher:computer ratio in the workshops be 1:1. Each participating teacher must have an exclusive access to a device to allow unconstrained participation and hands-on. Having more than one teacher on a device will seriously limit the learning of one or all teachers in the program. At the same time, one workshop should not have more than 25-30 participants, larger numbers will reduce participation by teachers and reduce effectiveness of learning. Smaller groups (less than 30) will provide more opportunities for teachers to voice their views, doubts/issues and discuss the same. These discussions are also useful to build personal bonds amongst participants, which would help in better team work and coordination as RPs.

The number of RPs to be trained from each district, would be a function of the number of candidate teachers in that district, to be trained. Teams of 5 RPs can be developed for each district. In case of larger districts, more RP teams would be required to share the load of training amongst teachers, to reduce the time spent by the teachers from their schools. If it is possible (and seen desirable), these teachers could be deputed to the DIETs during the period of training, so that they can be available without any constraints for the program.

Workshop preparation

Check list - ICT Lab readiness[7]

Continued learning

After being part of the training workshops, teachers may try some of the lessons they have learnt in the workshops, and share their experiences on the mailing-lists. They will create digital resources by using the applications and share resources. They will seek help when they face problems. Other members of the mailing-lists can provide academic, technological support, creating a self-sufficient learning community. Assignments for resource creation could be identified during the workshops and be completed and shared over the mailing-lists. Specific discussions on identified topics could also be carried out in the mailing-list, on topics of interest to the teachers, concerning their subjects and also larger issues in education.

Teacher educators and experienced teachers and college faculty can also be added to these mailing-lists to mentor and support the discussions on these forums, to facilitate teachers self-directed learning and peer-learning. During the discussions on the lists, it is likely that some teachers (who may not be from the known MRPs) will take lot of initiative to support

7 http://troer.telangana.gov.in/OER/index.php/Computer_lab_readiness_for_the_workshops

their colleagues. Thus providing a state-wide canvas can enable natural leaders to emerge, who put in effort to share their learnings and experiences with their colleagues and also respond to their support requests.

If required, the district teams can visit the school of any teacher to provide site-based academic and technological support, if the virtual support provided is not adequate. The teacher-education institutions can also use the PLC as a forum to discuss issues of educational and social concern and also to get inputs.

7.0.3 Virtual networks - professional learning communities

In all workshops, along with learning different digital methods for TPD and teaching, teachers will also enrol into PLCs. PLCs can be of different kinds - of teachers by subject in different geographies - at state and district levels, of teachers across subjects in a smaller geography - at a district or a block level or of subject teachers and TSG members. All teachers for a subject should certainly be enrolled into the state-wide PLCs for their subject, and learn to use software applications for connecting and learning, for sharing ideas, experiences and seeking help. The participants therefore are likely to continue to interact with one another after the workshops, through the mailing-lists and these interactions will continue between the district and state levels, for continued support and learning.

PLCs can be formed using one of more digital methods - such as mailing lists or mobile-phone communities. The state-wide PLCs should certainly include a mailing list. Phone based interactions tend to be brief and cryptic owing to the constraints in posting long text messages. Emails can provide a method for more meaningful and intense discussions amongst teachers and mailing to the PLC Mailing list should be strongly encouraged.

> Resource (illustration) - Karnataka state-wide PLC - Mathematics[8], Social Science[9], Kannada[10]

PLCs as autonomous spaces

It is important these virtual networks are autonomous. While they may be established as a part of the in-service teacher education programs, it is necessary that they not be considered as dissemination forums by the department officials. The discussions must be initiated primarily by teachers, on issues they consider important for themselves - these could be academic or administrative or even mundane.

Moderation of the forums

While the forums need to be autonomous and not subject to directions of the department, there is also a need for moderation of discussions. Administrators should take on the re-

8 https://groups.google.com/forum/#!forum/mathssciencestf
9 https://groups.google.com/forum/#!forum/socialsciencestf
10 https://groups.google.com/forum/#!forum/kannadastf

sponsibility of sharing guidelines for discussions (which would be evolved during the teacher education workshops) and facilitating adherence to. Posts which violate these guidelines require to be responded to and the authors alerted to these violations. While the enforcement need not be strict or severe it needs to be sure.

Check- list of guidelines for the virtual forums is available here[11]

11 http://karnatakaeducation.org.in/KOER/en/index.php/Become_a_STF_groups_member#Mailing_tips_for_a_STF_member

8 Developing capabilities for OER creation

A Professional Learning Community Approach for Teacher Development and OER creation - A toolkit[1]

Building Professional Learning Communities[2]	**Developing capabilities for OER creation**	**Institutionalizing the program**[3]

Open Educational Resources (OER) as 'materials offered freely and openly to use and adapt for teaching, learning, development and research.'

- Commonwealth of Learning[4]

8.0.1 Participatory digital resource creation by PLCs

Availability of quality curricular resources has been identified as critical to Quality Education by the National Curricular Framework 2005 (NCF). Traditionally, materials are created at the state level (by the SCERT) and disseminated to teachers. This has two potential limitations; one - reduced teacher participation in development of the curricular resources, and relative non-contextual content. Participatory resource creation can address both. The NCF position paper on Teacher Education also talks about how spaces of resource creation (resource forums and resource centres) are important aspects of Teacher Professional Development.

Secondly, materials created by the SCERT tend to be 'static'; once created, they are revised at infrequent intervals. This legacy approach is the limitation of a traditional 'print' based methods, which cannot allow for such continuous revision and publishing, as that would be far too expensive. However, 'content' is never 'complete' and needs continuous enrichment. Digital technologies can allow for more frequent revision of materials, which can lead to continuous enrichment.

After teacher professional development, the area in which ICT can make a significant difference is in the creation, revision and sharing of digital curricular content. Digital content creation and sharing provides the PLC an important rationale for its existence. Digital content becomes an important output of the PLC's activities. PLCs of teachers can support a dynamic model of OER creation, revision and sharing.

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1 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit

2 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/Building_Professional_Learning_Communities

3 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/Institutionalizing_the_program

4 https://web.archive.org/web/20130503135718/http://www.col.org/resources/crsMaterials/Pages/OCW-OER.aspx

8.0.2 Creation, revision, sharing and publishing of resources

Teachers can be exposed to a variety of digital methods for developing curricular resources, for different contexts and purposes. Moving beyond the 'text book' to include additional formats of resources can create a rich learning environment, in which teachers have a wealth of materials to chose from, based on their needs and priorities. Digital resources can supplement and enrich the existing print based resources (existing print materials can also be digitised). The availability of new digital tools allows for multiple and richer representations of content using images, simulations, videos, info-graphics, semantic maps, etc. Digital methods of transaction using these resources can enrich classroom pedagogies. (refer TPACK framework).

Since digital resources can be easily replicated, the marginal costs of sharing digital content is negligible. Teachers also need a common space where they can access resources for their classroom teaching, and also for TPD. The PLCs can serve as the forums where teachers can share the digital content accessed or created (or accessed and modified) by them, with their colleagues.

Teachers will also learn to access the world wide web for available OER and evaluate these and adapt these for their use. Teacher will revise and re-mix both accessed OER and created OER, to create new OER.

Resources so shared in the PLCs can be vetted and curated and those meeting quality norms can be made available on-line, for easy and universal access.

The NCFTE says, "Teacher education should engage teachers with the curriculum, syllabi and textbooks to critically examine them rather than taking them as 'given' and accepted without question". The processes of accessing, creating, reviewing, revising, sharing and publishing OER, definitely serves as an opportunity for teachers to engage with the curriculum, and go beyond the textbook for meeting their teaching needs.

8.0.3 Licensing digital content as Open Educational Resources (OER)

The size of the public education system in most states could help to create a sufficient volume of interaction in the professional learning communities. The networking of teachers using digital technologies can make the large size of the system as a strength, as the large number of teachers participating in the network could be a benefit in terms of the volume of resources created and shared by them. Even if only a very small percentage of teachers from the public education system participate, in absolute numbers, it is likely to be large enough to provide a base for resource creation.

It is necessary to license all these digital resources as 'open educational resources' (OER), since that would enable the resources to be freely re-used, revised and re-distributed. This also needs to be formalized through state curricular policy, by which all materials developed using public funding would be released as OER. If explicit licensing as OER is not done, the default copyright would apply, which is 'all rights reserved'. In this case, teachers cannot download and re-use the materials, or make modifications for enrichment.

Reference - OER policy of an educational institution[5]

8.0.4 Program for OER creation, revision and publishing

The initial phase of the PLC program can focus on building digital literacy and capacities for integrating ICT for TPD and practice. Subsequently, a program of OER creation can be designed within the PLC program. The steps for the OER program include:

1. Establishing a resource creation group and an resource review group
2. Designing the processes of OER creation, review, revision and publishing with the academic review group
3. Workshops for capacity building of select teachers in OER access and creation
4. Continuing OER creation by the OER teams post workshops, in virtual mode
5. Review of OER submitted, by the academic review group
6. Rework of the OER and final approval for publishing
7. Publishing of OER on the state OER platform

Establishing structures for the OER program

Two teams are required for the OER program - a state resource creation/ editing group and a resource review group. The first group will collaboratively develop the OER on different topics and the second group will review these resources and provide comments and feedback for improvement. Both groups can comprise teachers and teacher educators. The second group will need to have people who have depth of knowledge of the subject matter, pedagogies as well as be familiar with the academic standards and processes of the state. The number of members will depend on the scope of the OER program, preferably, for every grade + subject, the resource creation group should have at least 5 members and the resource review group should have at least 1-2 members.

Designing the processes of OER creation, review, revision and publishing

This will include the design of the content schema of the OER platform, considering parameters such as subject / discipline, class / grade, audience (teacher / student / public), language etc. The processes of content creation and review will need to be formalized, by identifying the people who would take responsibility for these. Parameters for resource review need to be established to provide the grounds for acceptance or rejection of a resource submission. The processes of making the content public on the platform (publishing) too need to be laid out (for instance if only approved materials will be visible or all resources), including identifying the person(s) responsible.

5 http://cuhimachal.ac.in/download/2017/april-2017/20170406165216794.pdf

Workshops for capacity building of select teachers in OER access and creation

The OER creation team will participate in face-to-face workshops, which should be organized by subject. In these OER workshops, teachers can be organized into teams and each team assigned (based on interest and or capacities) one or more topics from the state syllabus. Teachers can access existing resources for that topic, create resources using different digital tools, revise available and relevant OER to make new resources. The teams can also do an internal review of the resources and the plenary of teachers can review the work done by different teams during the workshop. The workshop would cover the following aspects:

1. Creating OER using different digital tools
2. Learning to edit and upload materials as well as provide links on the wiki
3. identifying other OER and freely available content (including mind maps, videos, images, audio clips, animations, Geogebra applets and other multimedia resources) and linking them appropriately
4. Classifying, organizing existing content
5. Providing metadata for the content
6. Peer review content created by others
7. Understanding the structures and processes for contribution, review and feedback of resources

`Resource - Agenda for a OER creation workshop - Mathematics`[6], `Science`[7]

Continuing OER creation by the OER teams post workshops, in virtual mode

The processes of resource creation does not have to stop with the workshops. The department could have a program of having teachers create resources, in a collaborative manner, over virtual networks and submit the same to resource review teams electronically. The queuing of these could be automatically configured such that resources created for a subject automatically would go to the relevant reviewer / review team.

In addition, the review team can also be part of the virtual forums, so that they can review resources that are shared on these forums as well. Teachers can also be invited to contribute resources to the state OER platform, through a form on the OER platform or by email.

`Resource - Specimen contribution form`[8]

Review of OER submitted, by the academic review group, rework by creator and approval

The review group will review the resources submitted by teachers. Resources that are 'approved', meaning those that meet pre-specified criteria, can be passed by the review group to the publishing team, for uploading on the state OER platform. If resources need

6 http://karnatakaeducation.org.in/KOER/en/images/0/0b/Maths_KOER_workshop_II_-_Sep_2-4.ods
7 http://karnatakaeducation.org.in/KOER/en/images/1/11/Agenda_-_Science_KOER_workshop_1_-_July_16_-20_2013.ods
8 http://www.karnatakaeducation.org.in/?q=node/337

to be reworked before they can be approved, the review team will share back the resources with the creator(s) with feedback for improvement. This process can iterate till the review group approves the resource.

Publishing of OER on the state OER Platform

Once the resource is approved, the 'publishing team' can upload the resource on the state OER platform, following guidelines for the process. The metadata for each and every resource in the repository must be provided, to ensure ease of access later.

As in the case of NROER, content may be of two types - content which has been reviewed for quality assurance and is 'published', i.e. visible to all. Content which has not undergone the process could be configured to be visible only to the person providing the content to the repository, and to the quality assurance team. Or all content, both approved, and waiting for approval could be made publicly visible.

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Resource - Check list for resource upload on the state OER platform
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Metadata

At the time of publishing of the resource, all the required metadata for the OER should also be uploaded into the repository. The NCERT uses around 31 metadata elements for its NROER data and these could be adapted by the state OER repository.

8.0.5 State Repository of OER (SROER)

Each state must have its own OER repository where all the content created by the department and by the teachers and teacher educators is shared for use of all.

The resources created by teachers and shared on the PLCs can be reviewed by expert groups, set-up by subject. The resources that are seen as valuable should be made available to all teachers on an on-line space. The on-line space can be designed using a FOSS Content Management System such as MediaWiki. MediaWiki is the software platform that is used by Wikipedia, the world's most popular OER repository. It has several features to support collaborative content creation and editing.

Read more..

Mediawiki is a software created to support collaborative resource creation by many. It is easy for editors to add digital content in different formats (text, image, audio, video, html etc) and to revise the content added by others.

A larger number of 'widgets' are available to 'embed' resources from other websites into the Wiki page.

Mediawiki keeps history of changes made on each page, allows ‘roll back’ to an earlier version

Editing is password protected and can be configured to be restricted It is easy to add new web pages and link the content to other pages on the site, as well as from other sites (external links)

Each page can be 'tagged' and pages can be collaged based on tags

Metadata can be stored for each file and each page using the 'Categories' feature.

An 'offline' backup can be taken on DVD / pen drive and shared to access without Internet

National Platform v/s state platforms - For a country like India, with a federal structure, the national level repository NROER[9] can be seen as a role model (like NCERT published text books) and states should set up their own OER platforms, just as most of them have designed and published their own text books. State platforms can encourage greater participation of teachers in OER creation, revision and sharing. Over time the state SCERTs should encourage DIETs / district groups to make their own localised resources and publish on state platforms, this can help bring to fruit, the 1995 MHRD guidelines for teacher education, which envisioned district level text books. In theory one platform for India can meet all requirements, in practice, states should have their own spaces for autonomous resource creation, revision, curation and sharing. Hence the resources created by the program should be hosted by the state governments as OER for wide use by teachers, and for adapting, revising and re-distributing.

Telangana has developed the state OER platform using the MediaWiki CMS. Andhra Pradesh also has its state OER platform. The Teacher Network[10] (on which this toolkit is available) can be used as a initial state repository. This site has been established and being maintained by IT for Change. Commonwealth Educational Media Centre for Asia (CEMCA[11]), an inter-governmental organization of the Commonwealth countries helped establish this platform.

8.0.6 Principles of SROER design

SROER design

Some pointers for designing the state OER repository are listed below:

1. Each subject should have its own subject portal. Each subject have sections for curriculum, text books, content, assessment/question papers etc
2. Each subject have class wise and chapter wise pages, on each page, the OER relevant to that chapter can be shared
3. The page for any topic should have both content and pedagogy, latter through 'activities' / 'projects' explaining the transaction and assessment processes
4. The site will also have external links to all useful resources.
5. The same content can also be viewed through 'resources type' view (multiple views)
6. The platform may be hosting content in more than one language (the platform can be built to support sites for each language, which is offered as a medium of instruction

9 http://nroer.gov.in
10 http://teacher-network.in/OER/index.php
11 http://cemca.org.in

in the state). The sites in the different language should be inter-linked to each other, for all pages/ topics.

Maintenance of the SROER platform

The platform will require technological maintenance, in terms of software upgrades for security and functionality, which will need to be done by the Technology Support Team at the state level. The content categorisation will also need to be regularly updated, to meet new requirements. The MediaWiki Content Management System adopted in both KOER and TROER has many features that support the easy maintenance of the platform.

Case - Telangana Repository of OER[12] (TROER)

8.0.7 Creation of OER in local languages

Collaborative OER creation could provide supplementing and complementing resources that are contextual, to teachers. A second aspect is that of language. Most of the OER developed and available are in the English language, and relatively much lesser in the 'home' languages spoke by the learners. For instance the Kannada Wikipedia (Kannada is the official language in the state of Karnataka, and spoken by vast majority of its people) has around 16,000 pages in contrast to the nearly 5 million pages in English. One of the focus areas of the 'participatory resource creation' of teachers in the sub-project 5 of ROER4D research program was the creation of resources in the local language. The study suggested that teachers have been able to create a large volume of resources in Kannada, including by translating and trans-creating materials available in English.

This model can thus enable the creation of contextual OERs in many more Indic languages. What makes this model even more potentially useful for India, is that in each state, the dominant language is different. Languages which are dominant in one state are spoken by people in the neighbouring states (at least in the border areas) as well. Hence OER prepared by Karnataka teachers in the Kannada language can be made available to Kannada language students and teachers in schools in Telangana, Andhra Pradesh, Kerala, Maharashtra and Tamil Nadu.

Most of the 30 state governments in India have their own (distinct) state languages. As per the 2001 census of India, 13 languages are spoken by more than ten million native speakers and 21 languages by more than a million. This requires OER in these languages, which the PLC teachers can support the creation of.

8.0.8 Toolkit for creating OER

For more information on how teachers can use these tools, please refer to the Teachers' toolkit for creating and re-purposing OER using FOSS[13]

12 http://troer.telangana.gov.in/OER/index.php/Main_Page

13 https://teacher-network.in/OER/index.php/Teachers%27_toolkit_for_creating_and_re-purposing_OER_using_FOSS

8.0.9 Challenges

1. Collaborative resource creation can be a challenge. Teachers need to learn and internalize working together to create resources, working both through face-to-face interactions and through virtual networks.
2. Quality assurance of resources created by the teachers can be quite difficult. To do a reasonably good review, expertise in content (subject matter), pedagogy of the subject and technology is necessary. This can be shared across members of the review team
3. Configuring and maintaining a technology platform can be a challenge for a state education department, due to lack of suitable staff. However, as ICT becomes an important and integral part of school education, education departments will need to set-up technology support teams, at state and district levels, hiring suitably or taking on contract, suitable resource persons.
4. Use of OER by teachers can also pose a challenge. OER may not be used due to several factors including non-availability of required infrastructure at the school, teachers not sensing a need to go beyond their text books, lack of time to explore OER and adapt for their teaching needs etc.

9 Institutionalizing the program

The practice of a teacher cannot be developed through quick-fix strategies and activities, without the development of an accompanying framework / theory on the process of learning and the aims of education.

- National Curriculum Framework for Teacher Education, 2010 (NCFTE)[4]

9.0.1 Integrating ICT into mainstream processes of the school

ICT program implementation in schools in India has usually through the BOOT (Build, Own, Operate and Transfer) model, where the implementation is outsourced to a business entity. In this situation the vendor provides basic ICT literacy to students, bypassing the regular teachers. Since the teachers are not a part of the ICT program, they have seldom evinced interest in learning ICTs for their professional development. This has meant that the digital capacities of teachers is usually poor.

Secondly, the regular subject teaching does not require the use of digital processes at all in most states, hence teachers do not need to become digitally literate. As a consequence, access to and creation of digital resources by teachers is rare in most states. The vendor does not have any incentive to renew the ICT infrastructure and at the end of the BOOT period, the assets transferred to the school are at the end of their lives. This makes the program non-sustaining.

However,there is an increasing move from the outsourced design of ICT programs in schools,to a greater role for regular subject teachers in delivering their subjects through the use of digital technologies. In this new approach, where the program is being implemented with the help of teachers, there is a need for teachers to become digitally literate. Education departments are also looking at how to develop locally relevant content, using the internal capabilities of the system, viz. their own school teachers, as suggested by the National ICT Policy on Education.

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1 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit
2 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/Developing_capabilities_for_OER_creation
3 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/Conclusions
4 http://ncte-india.org/ncte_new/pdf/NCFTE_2010.pdf

Adopting an in-house model, in which the ICT lab is part of school assets, owned by the school (similar to a Science or a Language Lab), can be the first step to integrating ICT into the schools own processes and institutionalizing it in school education. Once the school teachers 'own' the lab in the school, they can be expected to put in the efforts and invest the resources to keep the lab functional.

> Resource - Outsourced v/s in-house models of ICT integration in school education[5] provides a comparison of the BOOT model and the integrated model of providing ICT education in schools

9.0.2 PLC as a continuing model of TPD

The PLC-OER approach for teacher education provides a model for a sustained 'content agnostic' program, meaning the program can focus on subject matter or pedagogy or philosophy of education or ICT or a combination of these, in any year. The program content would be available on the OER portal and be the subject of on-going discussions on the virtual forums. Hence it is possible to 'continue' as well as 'cumulate' such learning. Gradually the PLC approach would not be adopted for a specific teacher education program, but its principles (forming teacher learning communities, who have been part of the specific learning program/processes) could apply to all of the in-service teacher education program of the state. Since the STF is a generic program, focusing on learning ICTs for TPD, it can incorporate any formal content. For instance, a topic like CCE or Adolescent education or gender could be chosen and the methodology of accessing the web for available resources, creating text-audio-video-semantic map resources in a collaborative manner by participating teachers can help in building understanding of the topic, and support teachers peer learning, during the workshop and also subsequently in the mailing-list conversations. As more teachers become members of the mailing-lists, the program team organising the training, can share indicate program notes, containing aims, scope, contents and methodology of the program on the mailing-lists and invite comments from teachers, and use these to further refine the program design. For instance, in the Karnataka STF program, the teachers came for a second round of training after a couple of years. In the second round, formal OER creation using these tools was focused on.

By making the access to an ICT lab a necessary part of the teacher education program, it also has the incidental benefit of restricting the number of participants in any program to a reasonable number, allowing for greater participation of the teachers.

9.0.3 PLC - Participatory TPD model

Continuing / persistent communities of learning can support sustained TPD. Interactions / conversations can be based on the interests and needs of different members. Teachers can seek help for their TPD needs from their colleagues on the forums. Teachers can also share

5 http://itforchange.net/policy-brief-%E2%80%93-icts-education-outsourced-versus-integrated-approach

their experiences, ideas and resources on the forums for others to feedback or to use. Thus PLCs provide spaces where teachers can feel comfortable to participate freely.

These spaces should be retained as autonomous spaces (not under the control of the education department) to allow for such free participation and mutual learning.

9.0.4 OER - Participatory model of curricular resources development

The activity of OER creation, revision and sharing provides a powerful rationale for the PLCs. It is seen that teachers are eager to use the different digital methods that they have learnt, to create and revise OER and share in the forums. It is also seen that other teachers respond with their comments and approval to the resources shared.

In this model, any teacher who is a member of the PLC can create and share OER, there is no other prior condition for this. This open forum can encourage many teachers to contribute. Teachers also feel a sense of satisfaction in sharing OER that they have created and may used in their own practice and for their TPD.

9.0.5 Role of FOSS in program institutionalization and sustainability

FOSS has a critical role to play in program sustainability. Since FOSS can be freely shared by teachers, there are no constraints to its use. Upgrades can also be freely downloaded to avoid obsolescence (not possible with proprietary software).

In the Karnataka and Telangana STF programs, teachers were provided with a single DVD containing the Ubuntu GNU/Linux operating system with all the educational applications and generic resource editors 'bundled'. This made the required software resources easily accessible. Teachers also learnt to install the operating system on computers, which many subsequently put to use, on their school and home computers.

This creates a 'free and open' approach to software which encourages teachers to explore, experiment and learn software tools.

9.0.6 ICT lab maintenance and renewal as a continuous activity

This has been discussed in the chapter on 'ICT infrastructure'. Once schools and teachers own the ICT Labs, they can be expected to invest energies and resources for its upkeep and renewal. The education department needs to provide an annual ICT Lab maintenance budget for the purchase of spares and consumables.

9.0.7 Main streaming ICT integration - Development of student text books and teacher hand books

The PLC-OER model can support improvements in the current models of development of text books. Traditionally, text book preparation is a time consuming process and the and the final production of the books tends to be time and resource intensive. Consequently,

text books are revised at infrequent intervals. Also the processes are usually managed by a small group of expert teachers and teacher educators.

The PLC-OER model can support the greater participation of the teachers in the text book design and development processes. Some of the advantages include:

1. Text books can have digital representation, in which image, audio, video resources can be embedded into the text resources to create richer learning materials, thus moving text books to multi-media books
2. The processes of refining the material can be continuous by allowing the editing of on-line 'beta' version of the books.
3. Translating the book into other languages can be more easily done on-line (this can enable the quicker creation of materials in the languages in which subjects are transacted in the state)
4. By allowing access to PLC teachers to refine/edit/improve (or make suggestions towards this process), the PLC-OER model can make the text book preparation much more participatory. Participation across space and time enabled by digital networks/forums can enable more teachers to contribute at their convenience and from their base locations. By licensing these materials as OER, the process can move from being point in time, centralized to being continuous, participatory.
5. Using a collaborative material development platform like MediaWiki can enable wider participation, continuous development and refinement/revision of materials. This can lead to a much greater availability of quality resources for diverse contexts, in local languages

Case - Telangana ICT student text book[6] and teacher hand book[7]

9.0.8 Continuous learning through blended courses (e-learning)

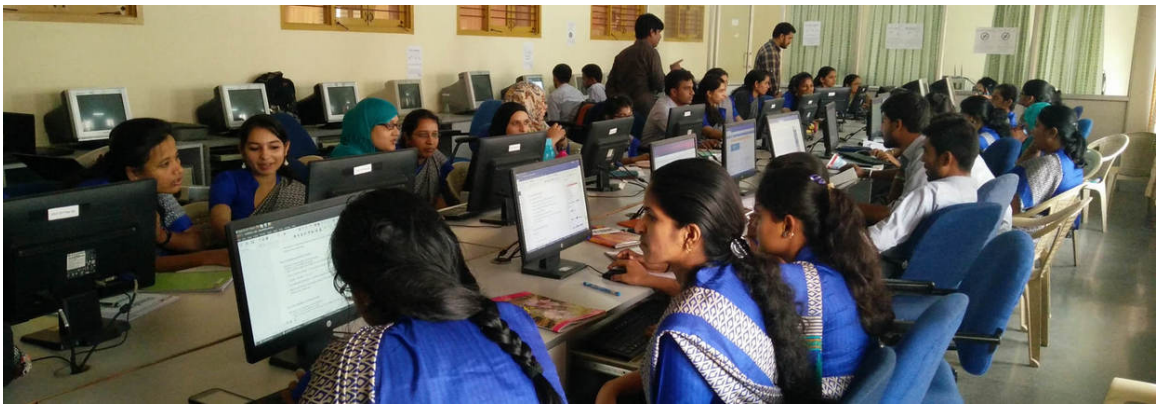

Figure 12 VTC Course for student teachers - Technology Integrated Learning, offered in blended mode

6 http://troer.telangana.gov.in/OER/index.php/ICT_student_textbook
7 http://troer.telangana.gov.in/OER/index.php/ICT_teacher_handbook

Once the teachers have been enrolled into the PLC program and made comfortable using ICT, they can become candidates to offer blended learning or e-learning programs to. (Many institutions are offering MOOC, without preparing the entire teacher population to become digitally literate, such efforts are likely to be premature and hence fail. Once teachers become digitally literate, courses can be designed and offered to them by SCERT.

Blended courses could be a part of the in pre-service teacher education programs as well. This will enable teachers to begin their careers with capacities in ICT integration, to support their own continuous professional development, in their subject-teaching and in the creation of OER. One of the consequences of the Karnataka STF program was the development of courses by IT for Change team, in collaboration with Vijaya Teachers College, for the student teachers and teacher educators of their Bachelors of Education program. The course is offered using Moodle, a popular Learning Management System (LMS).

> Resource - Course on 'Technology Integrated Learning[8]' for the Bachelor of Education program offered by Vijaya Teachers College

9.0.9 PLC for teacher educators / faculty of teacher education institutions

A PLC program for teacher educators succeeds than precedes program for teachers, since teacher educators are expected to design and conduct the program for teachers. However, in the case of ICT integration capacity building, it is preferable to design the program for teacher educators in the teacher education institutions, along with, or after the program for teachers.

In Karnataka, IT for Change implemented a program for the DIET faculty over a 3 year period, to build PLCs, with the help of CEMCA.

> Case - Teacher Educators - Communities of Practice (TE-COP)

9.0.10 Challenges to institutionalization

1. Sustaining the program despite any changes to the senior officers in the department / government, given that the PLC-OER program has to be rolled out in a phased manner over several years.
2. Maintenance and renewal of ICT infrastructure, including having TSG in-house
3. Collaborative OER creation is an academic challenge
4. Designing and implementing robust quality assurance processes to review and revise the contributions of teachers towards material development can be difficult due to lack of familiarity with the medium and processes.

8 https://karnatakaeducation.org.in/lms/course/index.php?categoryid=10

10 Conclusions

A Professional Learning Community Approach for Teacher Development and OER creation - A toolkit[1]
Institutionalizing the program[2] **Conclusions** **References**[3]

"The PLC has grown over the project period; a steadily growing exchange of information and resources; and increasing attention to contribution of resources. There is evidence of these resources being used in classrooms. Participating teachers spend their own time, effort and money, clearly making its sustainability a function of its quality rather than cost. The quality of the resources are also a function of relevance as perceived by the teachers themselves...Overall, the program presents an interesting model of ICT mediated collaboration and OER exchange, suitable for most contexts, particularly in the developing world."

- Case study of the STF-KOER program[4] conducted by Prof. Rajaram Sharma, Joint Director, Central Institute of Education Technology, NCERT.

Implementing the PLC-OER model in government school systems would improve the teacher development and curricular resource development processes and thereby support the national goal of an equitable education system.

10.0.1 Reforming perspectives on curriculum design and material development

Similar to the NCFTE 2010 perspectives on TPD, of moving from being point in time, centralized to being continuous, participatory, the collaborative OER model can help the curriculum, syllabi design and material development processes to also move from from being point in time, centralized to being continuous and participatory. Using a collaborative material development platform like MediaWiki can enable wider participation, continuous development and refinement/revision of materials. This can lead to a much greater availability of quality resources for diverse contexts, in local languages

1 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit
2 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/Institutionalizing_the_program
3 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/References
4 http://static1.squarespace.com/static/55371ac3e4b08f12059e3112/t/57e10de7d482e9072bfcc9d8/1474367057348/VIGNETTES+OF+SELECTED+ASIAN+EXPERIENCE.pdf

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National Policy of Education, 1986 (NPE).[8] Excerpt

National ICT Policy on education, 2012[9] Excerpt

National Curricular Framework, 2005[10] Excerpt

1 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit
2 https://teacher-network.in/OER/index.php/A_Professional_Learning_Community_Approach_for_Teacher_Development_and_OER_creation_-_A_toolkit/Conclusions
3 http://itforchange.net/policy-brief-%E2%80%93-icts-education-outsourced-versus-integrated-approach
4 http://personal.psu.edu/wxh139/Fullan.htm
5 http://mhrd.gov.in/rmsa_jrm
6 http://punya.educ.msu.edu/publications/journal_articles/mishra-koehler-tcr2006.pdf
7 http://ncte-india.org/ncte_new/pdf/NCFTE_2010.pdf
8 http://educationforallinindia.com/page58.html
9 http://mhrd.gov.in/sites/upload_files/mhrd/files/upload_document/revised_policy%20document%20ofICT.pdf
10 http://ncert.nic.in/rightside/links/nc_framework.html

Sharma, R. . Subject Teacher Forums and the Karnataka Open Educational Resources Programme - A Case Study, in Vignettes of Selected Asian Experience[11]. WOU Press. 2016. Edited by G. Dhanarajan. ISBN 978-983-3910-02-1 (ePub)

Teachers' toolkit for creating and re-purposing OER using FOSS[12]

User manual for FOSS applications[13]

11.0.2 Abbreviations

Term	Explanation
CTE	College of Teacher Education, the apex academic institution for teacher training for secondary education.
DIET	District Institute of Education and Training, the apex academic institution at district level for syllabus, curriculum and teacher training for elementary education.
District	Administration unit for education system, below the level of the state (provincial) administration
DSERT	Directorate of School Educational, Research and Training (http://dsert.kar.nic.in) the apex academic institution at state level for syllabus and curriculum development, as well as teacher training.
FOSS	Free and Open Source Software, also known as 'open source' software or 'free software'
IASE	Institute of Advanced Studies in Education, a teacher education to support TPD of teacher educators
ICT	Information and Communication Technologies (more specifically digital technologies)
ICT@Schools	Program of state governments in India, to introduce ICT in high schools
ITfC	IT for Change
KOER	Karnataka Open Educational Resources
NCERT	National Council for Education Research and Training
NGO	Non-governmental organization
PLC	Professional Learning Community. Specifically refers to the Subject Teacher Forums created by the STF (see STF) programme.
RMSA	Rashtriya Madhyamika Shiksha Abhiyaan, (see http://mhrd.gov.in/rashtriya_madhyamik_shiksha_abhiyan) the programme of the Ministry of Human Resource Development, Government of India (see http://mhrd.gov.in), for supporting secondary education.

11 http://static1.squarespace.com/static/55371ac3e4b08f12059e3112/t/57e10de7d482e9072bfcc9d8/1474367057348/VIGNETTES+OF+SELECTED+ASIAN+EXPERIENCE.pdf

12 https://teacher-network.in/OER/index.php/Teachers%27_toolkit_for_creating_and_re-purposing_OER_using_FOSS

13 https://teacher-network.in/OER/index.php/Explore_an_application

State	India has a federal set-up. The Union or Federal government is also referred to as the Central Government. The provincial governments are usually referred to as 'state' governments.
SCERT	State Council for Education Research and Training
STF	Subject Teacher Forum programme
TPD	Teacher Professional Development

12 Contributors

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2	Yogi[1]

1 https://teacher-network.in/OER/index.php/User:Yogi

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3 http://tango.freedesktop.org/The_People

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