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Position Paper

ICT mediation in teaching-learning

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1 Executive Summary

PSTE aims to develop teachers, with a deep understanding of the core disciplines of educational philosophy, sociology of education, cognition etc. and also aims to develop capabilities in student-teachers for life-long learning. These goals need to inform the use of ICTs. Limitations of current PSTE model, which need to be addressed in any mediation of ICTs, include rigid curriculum, behaviourist learning models, inadequate assessment support, as well as lack of efforts to build learning communities. However current ICT models in school education have certain limitations, which have ensured that such programs have limited impact on education, these include their design being technology driven, isolation of ICT program from mainstream teaching-learning processes, use of proprietary software and resources, and by-passing of regular teachers which dilutes any possibilities of their ownership and engagement. Fortunately, we now have second generation ICT programs which see ICTs as a sub-process of teaching-learning than as a stand-alone subject. These programs aim to address educational priorities, focus on the teachers and are transacted by regular subject teachers who use a wide variety of public digital resources, both software and content.

The mediation of ICTs in teaching-learning needs to have critical underlying principles for any appropriation of ICTs for education, derived from larger educational principles/policies. This position paper aims to support a common understanding on how ICTs can play an important role in supporting PSTE, that help align programs to frameworks such as the NCF 2005 and the NCFTE 2009. The underlying principles include seeing ICTs as another (important) curricular resource, thereby an integral part of mainstream education, and not be a black box that technology experts need to interpret for education; according primacy to the role of the teacher, ensuring public ownership of resources created and used in education, taking a critical perspective on ICTs as well as promoting constructivist approaches that privilege participation and co-creation over mere access.

The paper provides a 'layered' approach to integrating ICTs into teaching-learning processes in DEd., comprising of ICT literacy, free access to digital resources, peer review of resources, creating resources, sharing and publishing resources, connecting to teachers and teacher-educators and finally moving to blended models of teacher education. Such an approach can be implemented through a program that covers in a phased manner, ICT literacy, ICT integration into learning as well as blended learning systems. For this provision of required infrastructure as well as its adequate maintenance is essential and doable. The mediation of ICTs in teaching-learning has the potential to pioneer new models of TE that are self-directed, need-based, self-paced, decentralized, peer-learning based, mentored and continuous and providing a suitable location in the curriculum for this, is an essential starting point.

2 Introduction and background

The position paper on *'ICT mediation in teaching-learning*" discusses the background, aims, challenges and possibilities for the use of ICTs in pre-service teacher education (PSTE) and has been prepared as part of a review by DSERT, of the PSTE[1] (DEd.) curriculum. *An important departure from conventional approach to ICT education, is that, ICT is not treated merely as another subject, but rather as a process and method that could mediate new models of PSTE.* Such new models of teaching-learning, using ICTs, could support PSTE goals as well as address critical challenges and limitations in current PSTE models.

The Karnataka government has provided computers through various schemes like CLASS, Mahiti Sindhu and ICT Phase I, II and III projects for high schools and CALC for primary schools for computer education and computer based education to the teachers and students. Radio based audio-programmes and satellite based video programmes have also been implemented, covering different subjects. However, the D.Ed curriculum provides limited importance (3-4% of contact time) to ICT education. And even this little time emphasizes limited computer literacy and not using ICTs as a mediator in teaching -learning processes. As envisaged in NCF 2005, ICT can play an important role in the creation of resources, their sharing and use, to enhance teaching-learning process. ICTs can enable the student teachers to get diverse perspectives, connect to one another and to teacher-educators for peer learning and mentored learning, and to update their learning capabilities as well as knowledge in the changing world.

1 While few comments are made in the generic context of PSTE, this position paper is primarily for the DEd. Curriculum revision exercise of DSERT, Karnataka

The DEd program will not have a separate paper on ICTs, this is because, ICT needs to be seen as a methodology of teaching-learning, applicable to all subjects, and not as a stand-alone subject. This means, every teacher-educator will need to use ICTs in their teaching-learning, rather than one 'ICT' teacher-educator. This paper briefly discusses the possibilities for teacher-educators in mathematics, science, social sciences and language papers in the DEd. course. Similar possibilities for other papers can also be explored /extrapolated and it is hoped that the revised syllabi and text books will explicitly require the teacher-educators to use ICTs in relevant and meaningful ways in their teaching-learning.

3 Objectives of ICT mediation in teaching-learning (PSTE)

A teacher education curriculum framework needs to be in consonance with the curriculum framework for school education. A teacher needs to be prepared in relation to the needs and demands arising in the school context, to engage with questions of school knowledge, the learner and the learning process. The expectations of the school system from a teacher change from time to time, responding to the broader social, economic and political changes taking place in the society. The main goal/aim of PSTE is to develop student-teachers to become teachers. This includes:

1. Developing an understanding of educational goals and philosophies
2. Developing an understanding of social contexts, specifically understanding equity / inclusion
3. Building and deepening subject matter expertise
4. Learning rich and diverse set of pedagogies
5. Developing an understanding of assessment principles and processes, including CCE

The goal is also to support continued Teacher Professional Development (TPD / ISTE) of student-teachers. The student-teachers need to understand educational aims and philosophies, understand current situations and responses, be subject experts, learn rich and diverse set of pedagogies, evaluation techniques, so that they can use these techniques in their teaching profession and involve themselves in improving quality of school education. For the professional development of student-teachers, they are to be motivated and given opportunities to develop an active desire for learning and to focus on continuous and life-long development, including “learning to learn”. The outcomes of TPD include enhanced self esteem at an individual level as well as enhanced status of the teaching profession. These goals are indeed quite challenging.

With the onset and proliferation of Information and Communication Technology (ICT), there is a growing demand that it be included in school education. It has become more of a fashion statement to have computers or multimedia in schools, the result being that in spite of its potential to make learning liberating, its implementation is often not more than cosmetic. It is also often unfortunately touted as a panacea for shortage of teachers. Teacher education needs to orient and sensitize the teacher to distinguish between critically useful, developmentally appropriate and the detrimental uses of ICT. In a way, ICT can be imaginatively drawn upon for professional development and academic support. ICT has within a very short span of time turned out to be one of the building blocks of the emerging information society. Many countries consider understanding ICT and mastering its basic skills and concepts as part of their core education policy. Flexible systems that enable them to acquire capabilities for life long learning, in the emerging network society, have become a necessity for today's young people. There is an urgent need to convince the educational system which should play an important role in engineering the teaching- learning situation and to make it a more meaningful experience for both teachers and pupils. So NCF 2005 National focus groups position papers suggests the following for TE:

- Enable trainee teachers to access sources of information and create knowledge.
- Introduce teachers to flexible models of reaching curriculum goals.
- Help teachers to evaluate and integrate available materials into the learning process.
- Introduce use of media and technology-enabled methods of learning, making them inherent and embedded in the teaching-learning process of student-teachers

The field of ICTs is vast and hence a 'layered framework' comprising of 'literacy-access-review-creation-connection' layers needs to be considered for integrating ICTs into the PSTE processes.

3.1 ICT Literacy

It is essential for student-teachers to learn to use ICT tools like radio, video tools, computers etc. as well as methods such as information access, review, classification, communication and networking. For this, the student-teachers need to learn about both hardware (parts of computers, radio and A-V educational devices and assembling them) and software (to integrate ICT tools for effective teaching-learning and in education administration) skills[2].

The Kerala IT@Schools program provides an intensive and comprehensive literacy-competence in various hardware and software tools to all high school teachers in a well-designed layered program.

3.2 ICT to access resources

The power of the digital medium, especially the Internet is the ability to be able to access resources available across the entire world in a simple and quick manner. This includes access to resources (audio-video), through websites, institutional portals etc. Since digital space is very resource rich, student-teachers need to learn how to access what would be useful for their learning, and also in teaching. It is a powerful method to democratize learning possibilities by providing resource rich environment to all schools.

In all subjects, at the end of each unit, references need to be provided, which would provide extended learning possibilities for student-teachers on that topic. Such resources could be published texts, as well as web resources, films/documentaries etc. It is important to develop in the student-teacher, the ability to access a variety of learning resources on any topic/unit. It is also important to develop in student-teacher, the abilities to critically reflect on a text accessed, to assess its educational value, which would require assessing its authenticity, relevance, currency etc. It would also be useful to refer to resources that provide diverse perspectives on a given topic/issue.

Accessing digital resources for self learning needs to be emphasized as a TE method in itself.

3.3 To curate[3] digital resources

Along with accessing available resources, the review of existing resources, resources created by peers etc. is also an important learning process. This would include annotating / commenting on the document etc. Text editor features like recording and accepting/rejecting changes on a document from multiple reviewers, making available documents over mailing-lists/websites for wider review by peers, need to be made default peer review methods. Strengthening peer review would also strengthen the capabilities for collaboration itself as a larger method of PSTE. This process would also help to develop capacities to reflect, reason and make judgments.

Peer review needs to be considered as an important PSTE method in itself and requires to be seen as a default process, meaning any resource creation should seek peer review. This will also democratise peer review and make it a common process.

2 The section on alternatives provides details of ICT literacy possibilities. For an exhaustive description, refer Modes, Models and methods, a global perspective by Mary Burns

3 See http://en.wikipedia.org/wiki/Digital_curation

3.4 To create and share digital resources

Curricular resource creation is accepted as an important teacher development and empowerment process. In the digital space, it is easy to create, learn, share and publish resources. If the student-teachers develop the capability to create resources , they can share it with their peers and teacher-educators, and seek feedback. This facilitate them for self-learning and collaboration digitally. Activities, assessment questions, audio-video resources and blogs (e-journal) present collaborative resource creation and learning possibilities for student-teachers.

Collaborative capabilities enable teachers to form learning communities which is acknowledged as perhaps the a powerful method for continuing teacher education and empowerment. This process can also help to develop capacities to reflect, reason and make judgments. It would support decentralization in curricular resource design and development, which in itself is a powerful TE process.

In the pre-digital era, text had a prime place in teaching-learning. However, with suitable and powerful digital tools, learning resources that are audio or audio-visual in nature can be prepared easily as well, by both teacher-educators and student-teachers. Such resources can have high teaching-learning potential. Discussions on such resources created, covering aspects as underlying assumptions, inferences, interaction learnings during the making etc can provide rich learning possibilities. Peer review, curating by student-teachers as well as by teacher-educators can make teaching-learning a powerful and enjoyable process.

> **Creation of digital resources** ***needs to be considered as an important PSTE method in itself and needs to become the responsibility of a larger set of teachers and student-teachers. This is essential for ensuring a continuous creation of local / contextual learning resources in different learning environments***

3.5 To publish digital resources

Resources created in a collaborative manner, peer reviewed as well as expert reviewed can be easily published on websites of the institution or of the network of teachers. Such digital publishing using text/audio/video editors/web publishing tools needs to become a default.

The process of creation-collaboration-review-sharing-publishing can greatly support the creation of a resource rich environment of a reasonable quality, which can be a support to student-teachers in their learning as well as in their vocation as teachers. For a country like India (and a state like Karnataka), it would also be a powerful process for creating local/contextual resource material, including material in the local language(s). There is a great relative paucity of good learning resources in Indian languages in the Internet and this process, carefully designed and widely implemented, can go a long way to address this lacunae. The Delhi University-School Resource Network (USRN), has in this manner created valuable Hindi translations/commentaries of writings by Dewey, Tagore, Friere[4] etc.

> ***ICTs have greatly simplified the processes of publishing and this should be used to encourage a larger number of teachers to create learning materials in a systemic manner. This along with a system of peer review and mentoring can create a continuous process of learning resource creation and sharing for the use of all teachers.***

3.6 To connect teachers, student teachers and teacher educators and educationists

The aim is to enable student-teachers connect and communicate effectively with teachers, teacher-educators, community, schools and other institutions by digital mode - email, mass sms, audio-video meetings, blogs etc. Emails for all communication, mass sms, video conference meetings are simple ways of connecting

4 IT for Change. 2010. Report of study of the RRCE, USRN (www.ITforChange.net/education)

teachers on an a regular basis. Webinars (seminars over Internet using audio/video conferencing tools) are becoming a good complement to physical meetings, these can be organised much more often and can bring people together across space and time.

Institutions should connect to one another to share resources, faculty members virtually. Students in one institution should be able to access other institutions for this purpose. It is possible to visualise that different institutions would specialise in identified areas and acquire greater depth which could be made available to other institutions as well – for both teachers and student-teachers. This way the physical access to an institution would not be the only way to access the resources available in that institution.

3.7 Blended learning in PSTE

Complementing physical workshops/meetings with virtual interactions over a mailing-list or an e-learning forum such as moodle[5] needs to become the future of teaching-learning. Such programs need to be offered by DIETs to student-teachers which can allow learners to learn at their own pace (relatively) and also reach a larger number of teachers than is possible through purely physical interactions. The benefits of such an approach (blended learning) include learning extended beyond contact period, wider sharing of resources/ideas, sharing of issues/doubts as well as responses to doubts.

The outcome of these would be to use digital methods to support and strengthen self-learning, continuous learning, peer-learning, mentoring methods of TPD.

While the methodology of ICT mediation in a layered manner discussed here, covers the actual learning processes, a similar framework for assessing learning will also need to be developed. Such assessment will need to cover – assessing/understanding the current learning level and styles of the student-teacher, whether the student-teacher has acquired the capabilities at the specified level, what additional experiences are needed to help the teacher acquire these capabilities. Possibilities of certification of student-teachers at different levels will also need to be thought of over time. For example, certain teachers may acquire deep skills in reviewing material and suggesting changes/revisions etc. Their expertise as 'curators' could be acknowledged through appropriate certification as well.

3.8 Inclusive teacher education

There are specific methods of meeting the learning needs of student-teachers with disabilities. These include using alternative input devices (voice, gesture based), alternative output methods, text to speech (visual aid) etc. which can support the participation of teachers in digital forums and discussions as well as accessing information available in digital repositories. Such methods need to be actively explored by teacher-educators. Some institutions may also seek to build depth of understanding and expertise in this critical area which could support other institutions as well.

4 Enumeration of specific concerns

4.1 Recognizing the importance of ICT mediation in teaching-learning

A study initiated by Govt. of Karnataka in collaboration with Regional College of Education, Mysore titled “Evaluation of D.Ed. Curriculum of Karnataka: A report 2007, coordinated by Dr.C. G. Venkatesha Murthy reveals that only 3% of weightage is given to computer education in the first year D.Ed (4% in second year). Apart from this, it is also unfortunate that the prospective teachers are not exposed to various methods to integrate various other tools of ICT and construct their own knowledge. The first need is to accept that ICT mediation needs to be a critical component in PSTE. ICTs support new and powerful methods of teaching-learning that can address many lacunae and limitations in current PSTE, (discussed later).

5 Since Moodle is a public software, the course has customized it for its own specific requirements.

4.2 Educational concerns

ICTs need to address key challenges and aims of education and not be stand-alone. ICT models need to integrate into education in terms of curriculum and pedagogy. For both, the involvement of educationists in the design of ICT mediation is essential. Also ICTs need to be seen critically for their potential as well as dangers and limitations. For this, it is essential to move from first generation ICT models[6] (technology led) to second generation ICT models (pedagogy led) – this is discussed later.

4.3 Infrastructural concerns

The PSTE institutions need to be provided with the adequate infrastructure both academic (training in integrating the ICT resources to their regular teaching) and physical to use ICT's effectively. Computers and other devices need to be made available on a 1:1 basis so that access is not restricted and available when needed. Labs need budgets and personnel for maintenance and support. Continuous upgradation of labs, adding new facilities is required on a continuous basis, since this is a rapidly developing field.

5 Underlying principles guiding ICT mediation in teaching-learning

5.1 Educational Policy as basis for conceptualisation and design of ICT mediation

The professional preparation of teachers has been recognized to be very crucial for the qualitative improvement of education since the 1960s (Dr. Kothari Commission, 1964-66), NPE 1986 and so on. With the latest developments in the field of science and technology, the key role played by the teacher in the education system has only become more critical. Hence Teacher Professional Development (TPD), both PSTE and in-service play a crucial role in the larger improvement of the system. But very few concrete steps have been taken in the last three decades to operationalize this. The Yashpal Committee Report (1993) on Learning without Burden noted"...inadequate programmes of teacher preparation lead to unsatisfactory quality of learning in schools. ... The content of the programme should be restructured to ensure its relevance to the changing needs of school education. The emphasis in these programmes should be on enabling the trainees to acquire the ability of self-learning and independent thinking."[7]

In the NCF 2005, the section on Education Technology lays emphasis on the role of ICT's in meeting the challenges to realize the goals of quality education. To quote from the document, " ...the key to meeting this challenge is an appreciation of ET as an agent of change in the classroom, which includes not only the teacher and the teaching-learning process but also systemic issues like reach, equity and quality."

The NCF also highlights the role of ICT in PSTE and in school education. It envisages the role of Educational technology as an agent of change in the class room. RTE emphasizes that every child of age group 6-14 need to get quality education. Quality education includes: Access, enrollment, retention and Achievement. In this context the the use of ICT's right from tracking the children and to ensure that every child as achieved the minimum levels could be tracked by ICT.

The NCF TE 2010 document suggests "Teachers need to be creators of knowledge and thinking professionals. They need to be empowered to recognize and value what children learn from their home, social and cultural environment and to create opportunities for children to discover, learn and develop. Educationists are also of the view that the burden arises from treating knowledge as a 'given', as an external reality existing outside the learner and embedded in textbooks. This view of education points to the need to take a fresh look at teacher preparation. Education is not a mechanical activity of information transmission and teachers are not information dispensers. Teachers need to be looked at as crucial mediating agents through whom curriculum is transacted and knowledge is co-constructed along with learners. Textbooks by themselves do not help in developing knowledge and understanding. Learning is not confined to the four walls of the classroom. For this to happen, there is a need to connect knowledge to life outside the school and enrich the curriculum by making it less textbook-centered.

6 Discussed in detail later

7 Yashpal Committee Report (1993) Learning without Burden

The NCF TE further adds *"In this situation, it is necessary to conceive ways in which teachers can opt for different kinds of trainings, based on their interest and requirement, and along with the recommendation of school supervisors. "For this, it would be necessary for training schedules to be announced well in advance (at the end of each academic year, for the next year) and for processes to be in place to enable teachers to register for the trainings they wish to undergo. Processes for field support for training would need to be worked out by these agencies providing training, and this need not fall as a mass responsibility of the concerned CRP, or co-ordinator in-service programmes as is currently happening. Allocation of funds, training dates, duration and other logistics would need to be made more decentralized and based on individual teacher's preferences, thus, doing away with the current model of mass trainings, based on the one-size-fits-all design. Further training dates allocation could also include time spent in other professional activities such as seminars, conferences and other activities suggested in this chapter. Systems that would enable teachers to avail of long-term courses, sabbaticals and fellowships would also need to be evolved. A follow-up mechanism for keeping track of trainings and professional activities of teachers would need to be evolved and put in place."*

Some examples of new models which have been able to look at new models for teacher education are discussed in the NCF TE; the **Delhi University School resource network (USRN)**[8] which aims to build professional networks of learning amongst teachers in government and private schools, teacher educators in Govt. and private institutions, university departments of education. This program is also revising the D.Ed curriculum of Delhi and participants have created digital educational resources in Hindi and resources that link practice with theory. The **MA Education program of TISS** explores new 'blended' learning models for teacher education, using contact and distance modes of learning. A third program, the **Kerala IT@Schools program** provides opportunities to teachers to become resource creators in their own subjects - mathematics, science, social science, languages and enhance their subject matter mastery, using digital tools. These programs have been able to establish new models for knowledge access, construction, storing, sharing and publishing, using 'techno-pedagogical' principles and methods.

All three programs have a strong 'ICT' component. However the use of ICTs is driven by strong pedagogic principles / approaches and is not technology centered. Educationists and practitioners have designed these programs, not technology professionals. **Their program designs emphasize elements such as independent, need based, self directed and self paced learning with continuous mentoring; pioneering new models of teacher professional development (TPD), which are essential to enable the priorities and principles discussed in the RTE, NCF, NCFTE a reality in the Indian school system.**

5.2 ICTs as a curricular resource

5.2.1 Curricular framework principles for digital resources

ICT mediation needs to be driven by educational aims, designed by those working in education, with quality frameworks and rigorous academic processes. ICT needs to be seen as a pedagogical tool and not as a technology device or as a sophisticated typing tool. This means ICT curriculum and pedagogy need to be seen like any other curricular area. Clear educational aims, principles and priorities need to drive program design. This means program design structures need to have educationists, teachers, teacher educators. Technology experts may need to be consulted but should not have prime role in design. The challenges are primarily pedagogical in nature – how can ICTs impact teaching-learning processes. Technological challenges exist – fragility and rapid obsolescence of infrastructure, power, sheer variety of options available etc. however these challenges are relatively less formidable and our thinking needs to move towards seeing ICTs as another (powerful) pedagogical resource than a technological black box. This warning is worded strongly, since the bane of ICTs in education has been the adoption of technology-centric thinking and

8 The Regional Resource Centre in Education (RRCE), established in the Central Institute of Education (CIE) is an important hub of this network, providing support to network participants in knowledge access, collaborative construction and sharing.

designs which have not consulted educators, leading to program isolation and failure[9].

5.2.2 Nature of resources

The adoption of ICTs in education is essentially an educational issue, rather than a technology issue, hence our policy and program need to be anchored in sound educational perspectives. Since curriculum is the primary process of directing teaching towards fulfilling educational aims, digital learning resources (content) and digital learning tools/ processes (software applications), which together constitute curricular resources, need to comply with established curricular principles. An important principle of public education systems is that **curricular resources need to be publicly owned**, so that they are freely available to teacher educators, teachers and students without restrictions. In the case of traditional print media (books), the public education system does *not* use *proprietary* curricular resources, since that prevents the schools, teachers and students from freely sharing the resources and from customising them for their local needs. In the same manner, proprietary (*meaning privately owned, which is prohibited by the owner, from being shared or modified*) software and proprietary content should not be used in education.

Use of a large variety of free digital tools/resources helps move from a 'scarce (minimalist) proprietary digital environment' to a 'rich/diverse public digital environment'. Digital resources are non-rivalrous (sharing does not reduce availability) and hence promoting public creation/sharing of digital resources is perhaps the most important step to ensure systemic benefit from ICT mediation.

5.2.3 Use of ICTs as a culture

For a new technology to be widely beneficial, it needs to become ubiquitous. This means all need to learn and use ICT, and use it in a large variety of ways. Viewing ICTs as public learning resources can create this culture of widespread appropriation. Student teachers need to be trained in basic hard ware skills like assembling and removing the computer parts. This would give them confidence to handle hardware as well. Along with it they were to be trained in handling peripherals including printers, scanners, cameras, mobile phones, CDs. Both hardware and software skills are very essential for student-teachers. Student-teachers are 'digital natives[10]' and would take to this learning quite easily. However, the older PSTE faculty would be 'digital immigrants' for who a process of capacity building would be essential, so that they can learn, understand and guide student-teachers

5.3 Active role for teachers

As creators of resources, teachers need to customise /localize available resources, as users of resources, sharing and publishing resources. “Computer teachers” do not have a big role in this process, since what they teach currently - operating system and office can be easily learnt by student-teachers. Successful ICT program depends more on capacity building and capability building which are techno-pedagogical processes, maintenance and support infrastructure and mechanisms. Integrating ICTs into regular subject teaching-learning creates ownership and commitment amongst teachers which also creates desire to learn computers/ Internet. Computer literacy should not be standalone but an initial part of a computer-aided learning program. For instance, instead of having a session on how to browse the Internet, this can simply be a part of a science class, to explore science resources on the Internet. Such 'applied learning' would be much more useful and hence learning would be deeper.

5.4 Constructivist possibilities for student-teachers

When we think of ICT’s, we normally have a tendency to equate this with computer education. The past

9 See the idea of 'first and second generation' ICT programs and their differences, discussed later

10 Marc Prensky has written about the idea of digital natives – the new generation who grow up with a new technology and hence take to it intuitively. Digital immigrants have spent large part of their lives prior to the new technology and hence may tend to have some diffidence in learning.

experiments in India have shown that no program that is only equipment driven works well. ICT's can only be meaningful and effective if they constitute an integral part of teaching-learning processes. The NCF 2005 has its foundation on the constructivist approach. The constructivist environment in teaching-learning process also means that teachers need to be active practitioners, collaboratively creating resources and building a community of learning.

The central idea of constructivism is that knowledge is not fixed / pre-determined, but rather constructed by the learner in the process of learning. Some of the other major concepts of constructivism are that learners are unique, bring prior understandings to any learning situation, hence learning is situated and contextual; learning is an adaptive activity; learners may resist, accommodate or assimilate new learning; and learners interact through interaction with materials, resources, experiences and other learners.[11] ICTs can be used to provide curricular experiences that are aligned to these concepts.

5.5 Critical perspectives on ICTs

It is essential to understand the limitations of ICTs including inducing superficiality (due to over-abundance of information easily available), issues of authenticity (the Internet provides information from all kinds of sources, without any meta information about its reliability). The dangers from ICTs – lack of adequate cyber security can lead to cyber bullying etc. The world wide web is also a dangerous place, which needs to be understood and safe behaviors encouraged (and risky behaviors discouraged). Stalking, bullying are widespread phenomena on the Internet and also children and adult are exposed to violence and sex on-line. Children also are vulnerable to peer pressures for practices such as sexting. Teachers need to learn how to set-up and use firewalls and browser filters and also how they could explain to children and others the reasons for being careful on-line. An understanding of the mechanisms of the Internet – technological, political (including its governance), socio-cultural is also an essential knowledge for student-teachers.

Secondly proprietary control over digital resources is also an all pervasive phenomena which is antithetical to the basic educational principles of learning by sharing and collaborating. Large transnational companies which are monopolies in different areas, attempt to corner the market and lock-in institutions to their proprietary products. The large education system is specially vulnerable. This danger to the education process and system needs to be clearly understood and avoided by using only those resources which are freely shareable.

5.6 Policy on ICT mediation in teaching-learning

There is an urgent need for national and State level policies on the use of technologies in education. Such policies should address aspects like – educational objectives for introducing ICTs; nature of technologies, equipment; procedures for procurement and maintenance; phasing of implementation in schools; setting of standards for content; evaluation / cost – benefit analysis etc. Such policies should form the basis for an expansion of the use of ICTs in schools[12] and could discuss aspects such as:

1. Teachers require require significant capacity building in ICTs on a sustained basis to be able to use its best possibilities in their teaching learning. Secondly, using ICTs without a carefully thought out design can have negative implications on education. Hence the systemic use of ICTs to mediate teaching-learning needs to be carefully designed. It would be preferable to work with student teachers first, before seeking to introduce them in classrooms. In the same manner, high schools should be the place to initiate ICTs first, followed by upper primary stages.
2. ICTs could be used effectively for training and capacity building of teachers, resource persons at cluster and block and DIET personnel. Once ICTs are available at school level, they can be easily used for the purpose of transfer of information for Management Information System (MIS).
3. Internet connectivity needs to be considered given the nominal the costs and the huge potential educational benefits. The access needs to be liberal along with installation of firewalls for specific restrictions.

11 Mary Burns, Ibid

12 This covers areas beyond PSTE, but these would fall under the work of the student-teacher post qualification, hence briefly discussed here

4. The programme for introduction of ICTs should not neglect the aspect of maintenance of equipment and the payment of recurring costs of electricity, consumables and Internet connectivity.
5. It is suggested that ICTs in education should not be included under the district level innovation component, but should become a part of the State level plan. Allocations should be approved for this component only if a State / UT has developed a clear ‘technologies in education, so that decentralised projects too have a coherent underlying set of principles and design.

6 Critiquing the existing system

In this section the limitations of the current PSTE system as well as the limitations of current ICT models in teaching-learning are discussed.

6.1 Current PSTE model

The current model of PSTE has certain limitations, specially in the context of the emerging information society, which is information rich and dynamic and which supports creation of networks amongst learners. These include:

6.1.1 Rigid syllabi

Current syllabi is rigidly defined, there is less scope for regional variations, as well as dynamic changes to respond to the varied needs of learners. Syllabi is static/rigid across space (does not change based on context) as well as time (infrequent revisions,which leads to outdated syllabi)

6.1.2 Inadequate support for constructivist approaches

Current transaction models largely favour chalk and talk methods and didactic approaches. Responsibility of teaching largely lies on one person, the teacher-educator. Trainees largely tend to be passive recipients (reinforcing behaviorist models, which gets carried to the classroom; whereas the PSTE could be a good opportunity for student-teachers to break these behaviorist models and experience constructivist approaches)

6.1.3 No continuity of formal contact with PSTE institution or peers

There is not much formal connection between the students and teachers or amongst students beyond the classroom during the course duration and again post course completion.

6.1.4 Limited assessment of PSTE program

Currently there are no systemic processes for continuous feedback mechanisms on the purpose/content/methodology of the program, such feedback would be valuable as formative assessment to improve subsequent programs.

6.2 First Generation ICT models

Apart from limitations in current PSTE system, there are also significant lacunae in the current ICT models in education, which can be termed as 'first generation ICT models'.

“First generation” refer to ICT models which are technology driven in design (rather than by education policies and perspectives), where the curriculum is restricted only to basic computer literacy covering proprietary software applications and which are transacted by computer teachers. In contrast, second generation ICT models are driven by educational priorities and perspectives, curriculum pertains to mainstream teaching-learning / core subjects and is transacted by regular teachers, who use a wide variety of public software and content resources that are free to share and modify. Generation 2 models are more

successful in getting teacher ownership and commitment and in impacting teaching-learning processes and outcomes. Many ICT programs are first generation programs, having following limitations:

6.2.1 Technology rather than education driven

Programs designed largely by large technology vendors and ICT experts, who may not have a good understanding or experience in core education. This has been the case even in the introduction of ICTs in the business sector, where the first generation programs focused on areas like payroll and accounting, since the IT Managers did not have deep business understanding. Similarly first generation programs usually stop with providing hardware (and pre-packaged software).

6.2.2 Largely ignore/bypass teachers

Program is often transacted by computer teachers – who are trained in computer science and not in regular school subjects. Program bypasses teachers and goes directly to students through the computer teacher. Hence, the program is seen as a standalone experiment not connected to the regular teaching-learning processes in the school. **No curricular process bypassing teachers can scale or sustain**. Teachers do not feel ownership over program and hence are not committed, causing widespread failures (hardware museums) once the novelty of ICTs wears off. Research on these programs concludes that crores have been spent, but with little real or lasting educational outcomes.

6.2.3 Content mostly computer literacy, not very relevant to education

Curriculum pertains to basic computer literacy (Windows and MS Office) or consists of pre-packaged content (CD ROMs). Operating system and Office are pedagogically not relevant. Using only pre-packaged content can reinforce existing “behaviorist learning” approaches, making teaching-learning passive. Using proprietary software and content creates an environment of 'scarce resources', which has a constraining impact on learning.

6.2.4 Vendor driven, vested interests

Large vendors who are near monopolies have a significant influence on program and policy. Since ICTs are habit forming, investing in providing products to students creates huge rent-seeking possibilities. Hence many vendors offer 'free[13]' products which the schools only have the right to use, but not the right to share. This creates vendor lock-ins which is detrimental to public interest and to learning possibilities. The complete focus on hardware and software procurement, largely ignoring the issues of capacity building, infrastructure maintenance as well as use of other ICTs (radio, video etc) is partly due the pressures of vendors offering latest hardware and software gizmos to the education system.

6.2.5 Proprietary software and content

Most schools and education systems use proprietary applications, though free (mukt) applications are available and widely used elsewhere. This leads to huge avoidable outflows on license fees, upgrades etc. Also it creates a 'scarce (minimalist) proprietary digital environment'. Annexure 2 has information on why public education should use only publicly owned digital (curricular) resources and avoid using proprietary digital resources. **There is a need to create awareness about the nature of software as a non-rivalrous resource, and the necessity to adopt public digital resources should be emphasized among the student-teachers.** Technology is not a value neutral item and hence this awareness is essential, especially for student-teachers whose vocation it would be to create/share/spread knowledge.

13 Free as in “Muft”, whereas what we need is free as in 'Mukt'

7 Suggesting practical alternatives with justification / Broad contents, methodologies proposed

The current limitations need to be well addressed by a carefully designed program for ICT capacity building, covering both ICT literacy as well as ICTs for teaching-learning of the mainstream DEd. Subjects. Digital resources and methods can provide greater options to teachers and enable varied approaches, which can vary based on learners context, learning needs as well as program goals. Digital networks can support networking amongst teachers and teacher educators to support their learning and sharing beyond formal classroom and periods. These methods can also support continuous dialogue and feedback for improvement.

> *Of course the capabilities to use ICT methods for rich, diverse curricular experiences, connecting student-teachers with one another, continuous formative assessment are much much more than just ICT competencies and ICT needs to be seen as an enabler for supporting these processes when other required capacities also need to be developed alongside.*

This section discusses actual implementation of the changes to the curriculum for bringing in ICT mediation into teaching-learning. The changes are of three kinds.

1. Many of the suggestions dealing with ICT literacy and competence in using a variety of digital methods and processes for learning would be factored into the *'Structuring learning*' paper,. The first sub-section "ICT Literacy" covers this.
2. Many others would actually get into the curriculum revisions in other papers, such as mathematics, science etc. These relate to digital curricular resources available in these subjects as well as educational applications in these subjects that can support constructivist learning approaches. The second section namely 'ICT Aided Learning' discusses this aspect.
3. Few other points may require the creation of new teaching methodologies (blended learning) which would impact the overall transaction of the DEd. program. These are new possibilities for the education system itself, which the DEd. curriculum revision should take advantages of. The third section discuss this aspect.

7.1 ICT Literacy

ICTs is a very broad domain, and affects almost all other aspects of life, the socio-cultural, the political and the economic. Since education is concerned with preparing learners to become responsible citizens, there is a great need for student-teachers to acquire a basic understanding of ICTs as well as the new phenomenon called the Internet. Hitherto, we have focused very narrowly on basic proprietary software, but we need to expose student-teachers to a larger gamut of ICTs, so that they have basic understanding and can develop skills in areas that interest them. The course curriculum should hence cover the following

1. Basic hardware knowledge - Computers – laptops, net-books, tablets, radio and audio recorders, camera, Printer/peripherals; Cell phones
2. Basic software knowledge - Public operating systems[14] - virus free, free of cost/free to share, hundreds of tools, supports most languages
3. Basic knowledge of Internet and web based tools and resources including of cyber security – avoiding dangers and risks as well as basic website and web tools use (for creating and maintaining institutional resource portals etc)
4. Larger socio-cultural, political and economic implications of the emerging network society, an effect of ICTs[15].

14 For example GNU/Linux system

15 Eminent sociologists like Manuel Castells, Christain Fuchs, Yochai Benkler have written extensively on the impact of ICTs in creating the new inforamation or network society.

The goal in ICT literacy must be to expose teachers to a wide variety of ICT resources – hardware, software as well as content. This requires an emphasis on using available free / public digital resources.

Teachers must not treat ICTs as a black box – they should be taught to install even the operating system, open up hardware to study components. Programs that have done this[16] have seen enormous confidence developed in teachers. Learning to install software and freely installing it on multiple computers (without such act being a violation of law) serves as a significant inhibition destroying process and encourages teachers to begin a journey of learning in the digital world. Teachers become learners and teachers instead of being consumers/users who have no idea and no right to study, share or customise resources.

Inexpensive computers / devices that support access and participation in the digital space, need to be promoted on large scale, even now schools purchase desktops, which are *expensive, inefficient and obsolete*. There are inexpensive Netbooks with good power backup, need to be provided to all schools/ student-teachers (interest free loans to teachers to buy as personal computers must be allowed, to ensure access on a 1:1 basis for student-teachers as well as teacher-educators.

> *Teachers need to be given access to ICTs and made comfortable and competent in using ICTs before children are provided free access. The recent trend of providing ICTs to students (Akash, CAL, OLPC) without any similar provision for teachers can be dangerous, since teachers role in facilitating learning how to navigate the digital space is indispensable. Children left to their digital devices, without possibilities of a teachers mediation and guidance would may simply not make best use of the learning possibilities and also would be highly vulnerable to abuse in the digital space. The 'entertainment' potential of the Internet vastly surpasses that of TV and hence providing them access without any guidance/facilitation of teachers could be more harmful than exposing them to hours of television entertainment programs and could have distressing implications for learning.* ***A 'No-Teacher-Left-Behind' policy to ensure teacher access and use needs to be seen as a pre-requisite to distributing devices to students.***
>
> *Secondly tablets which are in nature of 'smart phones' do not allow full range of participatory possibilities to learners and hence are inferior from a pedagogical perspective, than computers[17]. This needs to be carefully considered.*

7.2 ICT Aided Learning / integrating ICTs into subject teaching-learning

The biggest failure so far in ICTs has been to treat it as a stand-alone subject, however it is a new and powerful method for mediating teaching-learning and hence needs to be integrated into different subjects. To integrate, the steps of accessing, reviewing, creating and sharing resources are to be structured into formal curricular experiences.

Existing digital resource repositories from governments and NGOs including audio resources (EDC), video resources, animation movies etc. should be made widely *accessible*. It is important to make the resources available in district repositories linked to state repository. Student-teachers also need to learn how to access the world wide web for resources, including principles governing quality, authenticity of resources, rules of fair use etc.

Student-teachers need to integrate ICTs into their subject teaching-learning, using varied *digital methods to create* learning resources:

i. using *educational software applications, such as*
   A. Maths – Geogebra, Bruch, K Turtle
   B. Languages - SCIM (multi-language typing), K Hangman etc. (language)

16 Kerala IT@Schools program or the Teachers Community of Learning program, Bangalore

17 Smart phones are not suitable for large text input which would be important for teachers. Also the default connectivity for phones – GPRS - is different from the broadband wireless. The principle of 'network neutrality' does not unfortunately apply to phone based Internet access, see http://en.wikipedia.org/wiki/Network_neutrality

C. Science – STEP, Stars, Stellar etc (astronomy), Kalzium

D. Social Science - Marble (geography), KGeography, OpenMaps

E. other subjects - Freemind (creative thinking) for creating concept maps

ii. *web tools* like wiki, blogs

iii. *digital tools* like video camera and video/photo/audio software applications including recordmydesktop, Kdenlive, Audacity etc. as well as CBTs such as spoken tutorials (www.Spoken-Tutorial.org[18])

Several kinds / methods of technologies or applications of technologies should be encouraged. These include:

1. Computer Aided Learning (CAL): students interact with the multimedia content with mediation of teachers
2. Computer Aided Instruction (CAI): The teacher centric instructional content is displayed by using large screen TV. Instead of regular CRT monitor, the CPU can be connected with TV with the help of Video Tuner card.
3. Satellite based education: The satellite receiving terminal, digital receiver and set top box could be placed at Audio visual classrooms. The TV used for CAI can be used for this program as well by plugging the satellite signal.
4. Radio Programs: Radio programmes are being used in some States for literacy, orienting teachers and even for students, during or after school. IRI is being implemented in a few States. The community radio policy can be used by PSTE institutions (like DIETs) to set up radio transmitters (at low cost) to broadcast educational programs and make these interactive through telephone-in possibilities.

Such a diversified use of technologies is more appropriate than using only computers. Hence ICT's in pre-service teacher education need to envision the inclusive and significant use of Radio, TV, computers, video conferencing, teleconferencing, mobile telephony, Internet etc. These interventions are used not only for continuous on the job professional development but also as tools to enrich class room teaching and learning processes.

Student-teachers need to be given opportunity to prepare lessons using ICT tools during their practice-teaching as well. They should be required to participate in projects that encourages them to collaborate amongst themselves using a variety of digital methods.

7.3 Blended learning in PSTE

Complementing physical workshops/meetings with virtual interactions over a mailing-list or an e-learning forum such as moodle provides new models of TE through ICTs. The TISS MA Education program (www.tiss.edu/maee) which is 5+ years old is able to offer the program to students across the country and also access faculty from across the country, because each of the four semesters consists of a 3 week contact period (on-site) followed by a 12 week course transaction over Moodle. Since Moodle is a public software, the course has customized it for its own specific requirements. Similar programs need to be offered by DIETs to teachers which can allow learners to learn at their own pace (relatively) and also reach a larger number of teachers than is possible through purely physical interactions.

Blended models also allow for greater possibilities for addressing the diverse and heterogeneous learners needs, since the teaching-learning is not restricted to the classroom and virtual learning spaces allow for greater one-one interactions, at space and time convenient to the teacher-educators and student teachers. Thus blended models can allow for catering to diverse learning needs, contexts and aspirations.

It is also important to note that the distant modes have been an integral part all over the globe[19] in Teacher professional Development and distance education is merging into blended learning, more effectively

18 NMEICT program of GOI. For more details about such possibilities, refer to Mary Burns report

19 IBID. Mary Burns report

combining contact period and on-line interactions. In the context of teacher education, distance learning has more than one aim and audience. It has been used as a *pre-service* teacher preparation method with "teacher candidates," mostly with extensive face-to-face preparation (often as part of a formal dual-mode institution, such as the University of the West Indies). In developing and developed-country contexts, it has been deployed as an *in-service* vehicle to fulfil a mandate to upgrade the knowledge, skills and qualifications of an existing teaching force. Finally, and predominantly within developed-country contexts, distance education, mainly in the form of web-based education, serves as a vehicle for *continuing education*, offering enrichment, enhancement and additional certifications for teachers who have attained at least a minimum level of certification in their content/grade-level area.

8 ICTs for planning

8.1 Individual learning needs

It is necessary that PSTE be based on individual learning needs and not on a supply driven model. Assessing learner needs is indeed complex – it cannot simply be based on what a teacher articulates as a learning need, since the teacher may not have a full perspective of what TE could constitute and hence the need has to be seen within the overall framework of TPD, as articulated in documents like the NCF TE. Nevertheless, learning needs need to be be derived from a dialectic between teachers and teacher educators and recorded in simple digital registers, which can eventually develop in to full fledge teacher databases in each institution. Such registers can provide inputs to design training programs. Over time, different 'learning strands' are likely to emerge from analysing such digital registers, which can showcase different learning trajectories. Such a record will also support greater student-teacher involvement in their own learning.

8.2 Career planning

There is a need to look at career possibilities of individual teachers. This means different career paths need to be identified, based on teachers development needs, career possibilities etc.

8.3 Work management

Calendar management using office suite can support tour diary management, meeting coordination and Work planning/scheduling. Simple calendar management tools in an email client such as Thunderbird can help teacher educators to track their own appointments/meetings, schedule meetings with others, check for conflict and publish their calendar on an automatic mode.

8.4 ICTs for assessment

As per the NCF 2005, assessment should be integrated into the teaching-learning processes and should be continuous and comprehensive. It should be formative, providing enough information to the student-teacher to plan future learning. ICTs can play a role in connecting teacher-educator and student-teachers on a regular basis. Teacher-educators can collect feedback from student-teacher and also share assessment on submissions using digital methods. The advantage of digital modes of sharing and assessing is that the work products/documents/submissions are available for others also to read, interpret and understand. So assessment itself becomes a process that creates resources for supporting the learning of all. *This helps us to move from 'assessment of learning' to 'assessment for learning' to 'assessment as learning'.*

8.5 Program requirements

8.5.1 Support within DIET / PSTE institution

One reason why ICT program fail is that ICT infrastructure is complex and fragile. While a blackboard once set-up needs very little maintenance, ICT infrastructure needs regular maintenance support. However, given the huge potential for benefit to the process of teaching-learning, the processes for creating and maintaining

the infrastructure needs to be developed as part of the program. Hence the program needs to ensure infrastructure availability - computer lab, Internet (preferably broadband wireless), with other ICT devices including radio, TV, camera, audio recorder, mikes, speakers handy-cams etc. A Lab attendant is required to secure and manage the infrastructure and maintain uptime. Digital library / repository should be maintained in the lab, variety of resources, classified with annotations/comments. Digital resources in DVDs should also be maintained for lending to faculty members and student-teachers.

ICT device costs have sharply declined and hence access is not a major issue. We need to move towards 1:1 access to ICTs so that its use is optimised, instead of being a “scarce commons” resource. Such 1:1 access will greatly encouraged ownership on part of the teacher-educators and student-teachers over the processes of learning using ICTs. This will support the extensive and intensive learning required in this area. Interest free loans should be offered to encouraged them to acquire their personal devices. **It should be clear that the opportunity costs of depriving teacher-educators and student-teachers access to and participation in the best learning possibilities is far far higher than the costs of the devices and Internet access.**
Tethered devices like desktops are obsolete, inefficient and expensive (since they need persistent power backup, do not come with wireless access, video-conferencing capabilities) – instead laptops, net-books and tablets should be the preferred devices. Similarly Internet access through broadband wireless should be preferred to wired access.
Budgets for creating and maintaining the infrastructure need to be provided as part of AWP&B. Maintenance budgets should be at least 15% of the infrastructure acquisition costs and provided each year.

DIET / DEd. institution also needs to have subject specialists in different ICT tools/methods, and the current DEd. teacher-educators need to be trained on these aspects. District resource portal champions are also required to be developed amongst teacher-educators and then in student teachers,

No separate 'computer teacher' are needed for transacting and basic computer literacy can be taken care of by the teacher educators and teachers. The implication of seeing ICTs as a method of teaching-learning is that ICTs will not be the responsibility of one teacher-educator. All teacher-educators will need to bring in ICTs in relevant ways into their subject teaching-learning. **This means along with the text-book revision, there is a need to have a program for capacity building of teacher-educators. Such capacity building needs to cover both skill (use) as well as understanding (covering awareness of the potential and limitations/dangers of ICTs), so that the teaching-educator would take initiative in the use of ICTs in teaching-learning and there would be no need to use any compulsion.**

Such a widespread program of capacity building for teacher-educators can be part of existing teacher education programs or separately planned or funded. DIETs can also be provided autonomy to utilize from their funds for these expenditures.

8.6 Methodologies

The methodologies that this subject can promote, which would be useful to all student teachers would include self learning - reading / accessing resources, writing, sharing, publishing using digital methods and resources. These processes are indeed possible without digital resources, however, digital methods and resources extend the scope and learning possibilities for such work. Apart from this, ICTs should also be used to support and facilitate group learning (using email lists and wikis), project based learning as well as community (of student-teachers and teacher-educators) interaction.

1. There is a need to go slow and steady – build in a phased manner, beginning with interested teacher groups/locations and as the project matures and deepens, expand across the state/country. Focus first on teacher educators and then student-teachers
2. *Focus o*n capacity building and not just on hardware and software. Using inexpensive net books or tablets will keep hardware costs low, using only free software will avoid license fees on software. More than 50% of resources should be invested on in-house teacher education of both teacher educators and student teachers on a continuous basis.
3. Move to 'maximalist' free educational software tools environment from 'minimalist' proprietary environment. Move to 'maximalist' free educational software tools environment from 'minimalist' proprietary environment. Public education system should not be locked into 'proprietary digital

educational resources' which does not give the system any right to study, modify, customise or share freely.

8.7 Allocation of contact time for ICT mediated learning

Currently very little time is alloted for ICTs, and the focus is only on basic computer literacy. Since we are suggesting expanding the scope of literacy to cover ICT literacy (and much higher level of competence) and ICT integration into teaching-learning, the number of contact hours (periods) allotted need to increase. There need to be more periods for computer literacy itself, but along with this, we also need to earmark periods in other subjects – specially mathematics, science, social sciences, language, practice teaching, in which we have 'ICT lab/work' time in which student-teachers can use educational tools, access and create resources and also build their networks of 'learning communities'.

8.8 Suggested Roadmap for ICT integration into PSTE

No	Activity	Resources required	Indicative costs (for a DIET with 100 students)
1	Create / upgrade required ICT infrastructure in each institution	Computers, Internet, camera, audio recorders, storage devices. Broadband wireless connectivity	100 access devices would cost 20,00,000 and this can be acquired over a 3 year period. Other costs would not be more than couple of lakhs. Various programs of central and state government provide budgetary support for acquiring ICT infrastructure
2	Build basic ICT literacy capacities in teacher-educators	Master resource persons to train the teacher-educators	Training costs, based on a blended model, combining 10 days workshop based, spread over 3-4 phases and a on-line email/portal based interactions
3	Build capabilities in teacher-educators to use ICTs for their subject teaching-learning	Master resource persons to train the teacher-educators	Training costs, based on a blended model, combining 10 days workshop based, spread over 3-5 phases and a on-line email/portal based interactions
4	Build capabilities in teacher-educators to use ICTs for their own continuous and life-long professional development	Master resource persons to train the teacher-educator	Annual program of training for teacher-educators, on a blended model, combining 5 days workshop based, spread over 1-2 phases and a on-line email/portal based interactions
5	Teacher-educators to work with student-teachers as a part of the revised curriculum to support their layered learning for ICT mediation in teaching-learning	Teacher-educators	Part of regular PSTE program.
6	Maintenance of the infrastructure	Lab attendant, consumables	Around 15% of the capital costs should be provided for maintenance and upgrade of infrastructure
7	Maintaining a web-portal /e-learning system (can be done as a second phase, after basic capacity building of all teacher-educators in first phase)	One web administrator. Resources for the portal would be created by the faculty as a part of their regular teaching and research work.	Apart from the web administrator, the costs of maintaining the portal would be around 10,000 per year.

8	Offering blended courses	Course creation and administration costs – largely part of people costs and should susbume into regular activities of the institution	Designing courses offered on a blended model with a large virtual component can be coordinated by DSERT with identified DIETs. Courses and faculty can be virtually shared across institutions

9 Precautions / disclaimers/ do's and don'ts / desirables and undesirables

While the paper does cover the desirables and undesirables in different sections, we produce few important ones in point form here.

1. ICT in education is a pedagogical issue and hence its design and implementation needs to be driven by those with a deep understanding of education, especially the core areas of educational philosophy, sociology of education and cognition. It should not be driven by technology experts without such a educational understanding
2. Focus less on computer literacy, and more on integrating ICTs into regular teaching-learning, since this is what would interest the teachers and student-teachers
3. Avoid using proprietary software since it conflicts with the primary principle of teaching-learning which is to share, and build on existing knowledge by modifying/extending what is available. Use only public digital resources including software, which allows the freedom to share, modify and distribute.
4. Keep a critical perspective on ICTs, avoid treating them as magic bullets.
5. Look at the entire gamut of ICTs, beyond computers and Internet. Bring a variety of digital methods into the curriculum, so that different needs can be met.
6. Focus on resource creation as much as on resource use – uploading is as important as downloading
7. ICTs are fragile, ensure maintenance and support budgets are adequate. Else the huge initial investment would go in vain. Budgets must be provided as part of AWP&B
8. Hardware supply, maintenance could be outsourced (hence we can have a private *'lab attendant' but not private teacher* for computer aided learning). A resource person from a private company cannot replace a subject teacher but can be a good support lab attendant to take care of computer infrastructure

10 Abbreviations, references and annexures

10.1 Abbreviations

AWP&B	Annual work planning and budgeting
AV	Audio-video or audio-visual
CAL	Computer aided learning
CALC	Computer Aided Learning Centre.
CPU	Central Processing Unit
CRT	Cathode Ray Tubes
DIET	District Institute of Education and Training.
IRI	Interactive Radio Instruction
MIS	Management Information System

NCF	National Curricular Framework
NCF TE	National Curricular Framework for Teacher Education
OLPC	One laptop per child
PSTE	Pre-Service Teacher Education
RMSA	Rashtraya Madhaymaika Shiksha Abhiyaan
RTE	Right to Education (Act)
TPD	Teacher Professional Development

10.2 References

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10.3 Annexure 1 - First and second generation ICT programs

First generation ICT programs in school system – use a 'technological perspective'.

1. Program usually stops with providing hardware (and pre-packaged software). Curriculum pertains to basic computer literacy (Windows and MS Office) or consists of pre-packaged content (CD ROMs). Operating system and Office are pedagogically not relevant. Using only pre-packaged content can reinforce existing “behaviorist learning” approaches, making teaching-learning passive.
2. Program is often transacted by computer teachers – who are trained in computer science and not in regular school subjects. Hence, the program is seen as a standalone experiment not connected to the regular teaching-learning processes in the school
3. Program bypasses teachers and goes directly to students through the computer teacher. No curricular process bypassing teachers can scale or sustain.
4. Teachers do not feel ownership over program and hence are not committed, causing widespread failures (hardware museums) once the novelty of ICTs wears off. Research on these programs concludes that crores have been spent, but with little real or lasting educational outcomes.

Second generation ICT programs in school system – based on 'pedagogical perspectives'

1. Curriculum pertains to regular school subjects and issues of education

   (b) Mathematics, Science, Social Science, Languages

   (c) Curriculum in the ICT program is transacted by regular teachers

   (d) Teachers use three kinds of *digital methods to create* learning resources

   i. using *educational software applications* like Geogebra or Freemind

   ii. *web tools* like wiki

   iii. *digital tools* like video camera

   (e) Use of a large variety of *free digital tools/resources* helps move from a 'scarce (minimalist) proprietary digital environment' to a 'rich/diverse public digital environment'. D*igital resources are non-rivalrous (sharing does not reduce availability) and hence promoting public creation/sharing of digital resources most important*

   (f) Teachers use digital networks to learn from one another and support one another

   (g) High level of ownership and commitment of teachers and institutions leading to breadth and depth of use of ICTs by teachers in teaching-learning with beneficial impact on educational processes and outcomes

   (h) ICTs no longer seen as an isolated 'subject' but as an integral curricular resource, creating a new discipline 'techno-pedagogy'

   (i) Focus on continuous *capability building* - essential since the world of ICTs is fast changing.

   USRN (Delhi) and TCOL (Bangalore), STF RMSA (Karnataka) and IT@Schools Kerala are examples of second generation ICT programs in schools. These have higher ownership of teachers who integrate ICTs into their own teaching-learning processes and outcomes.

10.4 Annexure 2 - Proprietary Software and Proprietary Content vs Public Software and Content

Since the adoption of ICTs in education is essentially an educational issue, rather than a technological one, PSTE policy and program need to be anchored in sound educational perspectives. Curriculum is the primary process of directing teaching towards fulfilling educational aims and digital learning resources (content) and digital learning tools/ processes (software applications) which constitute curricular resources, need to comply with curricular principles. An important principle of education is that curricular resources need to be publicly owned, so that they are freely available to teacher educators, teachers and students without restrictions. In the case of traditional print media (books), the public education system does not use proprietary curricular resources, since that prevents the schools, teachers and students from freely sharing the resources and from customizing and using them as per their local needs. Proprietary software and content forces the teacher to be a 'mere user'; treating these tools as a 'given'. Teachers, schools and the entire public education system become completely dependent on the vendor for any changes, modifications, enhancements / customizations to these tools and have no right to freely share these resources with one another. Thus allowing for use of privatized digital learning processes (in the form of proprietary software or content) would be detrimental to education and the public education system should use only publicly owned curricular resources.

There are free software applications for all the areas where proprietary software applications have been used in schools. At a systemic level, public software has been used in a successful “ICT@schools” program in India – the Kerala IT@SchoolsIT@Schools, which is being emulated in Gujarat. The 'Subject Teacher Forum' program of RMSA, Karnataka uses public educational software for mathematics, science and social science teachers.

Proprietary software and content forces the teacher and the student to be a 'mere user'; treating these resources as a 'given'. Teachers, schools and the entire public education system become completely dependent on the vendor for any modifications, enhancements, customizations or localizations (creating local language versions) to these tools, and have no right to modify or freely share these resources with one another. Proprietary resources thus do not allow the needed experimentation, collaborative construction, and local/ contextual enhancement of learning processes, important new opportunities offered by digital technologies, required to meet the constructivist ideals aspired for by numerous policy documents including the National Curriculum Framework 2005. Thus using privatized **digital learning processes (in the form of proprietary software or content) is detrimental to educational aims,** and there is a strong case for the education system to use only public software (popularly known as free and open source software) and public digital curricular resources.

In addition, use of publicly owned software has other important advantages:

1. Since publicly owned software can be freely shared, the costs of using freely shareable software applications would be much lower specially for implementing at a large scale, where support systems are feasible to build. An IIM-Bangalore study estimate that on a conservative basis, Kerala IT@SchoolsIT@Schools program has saved 50 crores on software license fees and India would save 20,000 crores each year by adopting the same.

2. The GNU/Linux publicly owned operating system is virus-resistant and this can hugely reduce maintenance and support efforts and resources. A large number of computers in educational institutions tend to be unused due to virus issues and using GNU/Linux would increase infrastructure availability.

3. A large number of educational software applications can be bundled with the GNU/Linux operating system which means they can be available to teachers and schools in a simple single installation process. The Kerala, Karnataka and Gujarat programs all use the Ubuntu GNU/Linux operating system which is simple and easy to us, bundled with the educational tools.

Thus education system should encourages the use of digital tools and resources that are freely shareable and modifiable, in line with other curricular resources and discourages the use of software or content which is privately owned and which teachers and education system is legally and technologically prevented from sharing/customizing

10.5 Annexure 3 - Public Software - Education Tools

Application Area	Public Software	Description
SCIENCE	Kalzium	This shows the periodic table and the properties of elements. It acts as 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, all planets, etc.
	Stellarium	This is a desktop planetarium software that shows exactly what you see when you look up at the stars.
	PhET	Fun, interactive simulations of physical phenomenon
	KTechLab	This tool can be used to build your own circuits and explain its various components
MATHS	Geogebra	An algebra and geometry package providing for both graphical and algebraic input
	Tux Math	A fun game through which children can practice 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	KTurtle	The turtle will follow whatever directions you give it. Can be used to draw various symmetrical figures and is a good exercise of logic.
SOCIAL STUDIES	KGeography	Quiz on different states and capitals across the globe
	Marble	This acts as a desktop atlas.
ENGLISH	KHangman	Guess the correct work with a certain number of guesses allowed
	KAnagram	Unscramble the word
	KLettres	Identify the alphabets by recognizing the sound
	Tux Typing	Tux Typing" is an educational typing tutor for children.
INCLUSIVE EDUCATION	ORCA	ORCA, is an open source software (screen reader) for persons with visual impairment. As it is open source, it has been modified and made available in Kannada. It uses various combinations of speech, Braille and magnification and helps provide access to applications and tool-kits
	Other Tools	To be explored

Public software tools available and widely used on personal computers

Area	Proprietary	Sarvajanika Tantramsha/Software
Operating system	Microsoft Windows	Ubuntu GNU-Linux / Bhartiya Open Source System (BOSS from CDAC)
Office Applications	Microsoft Office	Open Office / LibreOffice / Bhartiya OpenOffice (from CDAC)
Email client	Microsoft Outlook	Mozilla Thunderbird / Evolution
Internet Browser	Internet Explorer	Mozilla Firefox / Chrome
Desktop Publishing	Page Maker, Corel Draw	GIMP, Inkscape, Scribus
Video editing	Adobe photoshop, Pinnacle	PiTiVi, Kdenlinve, Openshot
Animation	Adobe Macromedia	Blender

Assam, Gujarat, Tamil Nadu, Orissa and Kerala use these applications in their school programs.

One reason for using the proprietary software, is that most documents created and shared are in proprietary formats (.doc/.xls/.ppt). However, this creates a 'vendor lock-in', which is detrimental to public interest. Recognizing the dangers from proprietary/ closed standards, the DIT, Government of India has notified, in November 2010, the 'policy on open standards in eGovernance' (http://egovstandards.gov.in/notification/Notification_Policy_on_Open_Standards_-_12Nov10.pdf/view and http://egovstandards.gov.in/feedback_page?feedbackid=75) in which it is mandated that office documents should be shared only in the ODF format (.odt/.ods/.odp, which are the native formats used by open office/libreoffice, both free software office suites) and not in proprietary formats (.doc/.xls/.ppt).

10.6 Annexure 5 – Resource access, creation and sharing by teacher community

1. Kinds of digital resources to **access and capacity building**

Local resource repositories - Institutional portals (www.SchoolWiki.in), Audio-video resources

World wide web - using search engines/how, wikipedia, dictionaries, video resources (www.KhanAcademy.org), System's portals (www.Sakshat.Ac.In, www.ITSchool.gov.in)

Kinds of resources that can be created include text resources (www.ElEdu.net), translations, lesson plans, Activities, assessment questions, blog a a e-journal for teachers and audio resources created using free tools like audacity. video resources - kdenlive / pitivi / openshot, recordmydesktop

2. Resources that can be used in teaching-learning process.

Subject areas

Mathematics – geogebra, k turtle, bruch

Science – phet, step, ktechlab, kalzium

Social Science – geography- marble, kgeography, openmaps

Language – SCIM, Klettres, Khangman

3. Resource for creating a learning community.

(http://RMSA.KarnatakaEducation.org.in), customise /localise available resources, as users of resources, sharing and publishing resources, Members of communities of learning (www.ElEdu.net)

Program needs to encourage setting up of teams of student-teachers and teacher educators to create large volume of digital resources (which are easy to share across) in different subjects using amazing variety of free software tools created by teachers world over. Kerala school wiki, MHRD NMEICT are good examples of teachers creating digital resources for learning. Bilingual resources can be shared across states

The University School Resource Network (USRN) program of the CIE, DU has done pioneering work in connecting teachers with teachers, connecting teachers with teacher educators, schools with colleges and universities, for communication/networking, discussing issues relating to classroom transactions as well as larger educational issues. Participants have translated important works (by Dewey, Tagore, Giroux, Freire) into Hindi.

The role played by the digital networks is critical – it allows for interested student-student-teachers (who are seldom to be found in the same institution) across geographies to work together on an issue or item of common interest and use their collective energies and capabilities to create a learning resource that would not be possible for any of them to do individually, or if collaboration were to be restricted to physical interactions which are difficult to organise on a sustained basis. In fact research[20] from advanced countries suggests that teacher communities of learning can be one of the most powerful methods for TPD and teacher empowerment

Competitions for student-teachers to collaborate and create resources in teams could be organised by DIET at a district level. All resources created could be reviewed and those of a good quality could be made available on the portal.

11 Suggested inclusion of ICT mediation in different subjects in revised DEd. Syllabi

Specific suggestions for including ICT mediation possibilities in following subjects are made here:

1. Structuring Learning
2. Science
3. Mathematics
4. Social Sciences
5. Languages

Similar ideas will need to be extended to all other subjects as well. It would cover the use of web-resources, web tools, digital audio-video resources as well as educational software applications. All resources used should be freely shareable, which is both an educational imperative as well as to make it economically viable. Whether practice-teaching, or physical education or history or educational philosophy, these digital methods would be very useful in broadening and deepening understanding of the teacher-educator as well as the student-teacher

12 Subgroup #2 - Structuring Learning

The key focus of the NCF 2005 document is to restructure the teaching-learning processes to allow for constructivist possibilities. This is possible when one looks at the context of the learner and design contextually and cognitively appropriate learning experiences. The classroom processes and learning resources must be structured in such a way so as to allow for these learning experiences.

12.1 Framework for creation of learning resources

12.1.1 Concept Mapping

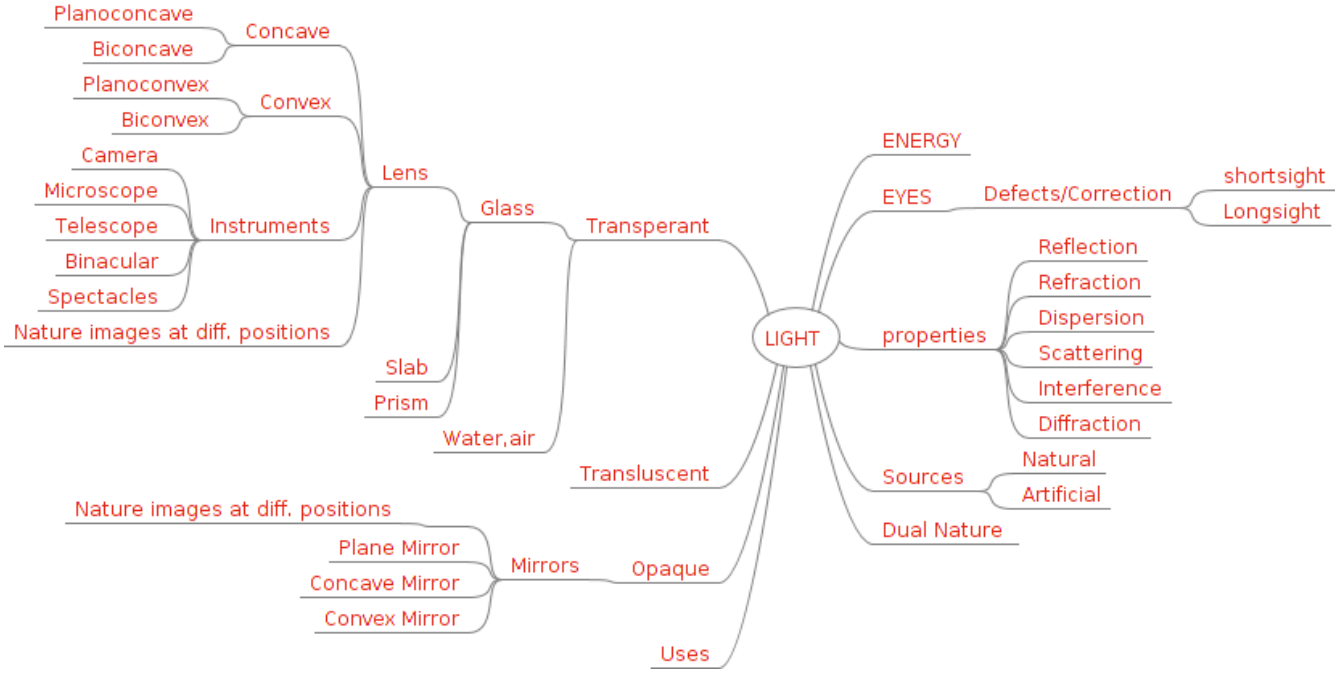
Vertical thinking (hierarchical) was considered to be the way for developing an understanding of a subject. Increasingly research is showing that lateral thinking is effective for problem solving through a non-hierarchical and creative approach, using reasoning that does not follow any particular hierarchy or sequence and involving ideas that may not be obtainable by using only traditional step-by-step logic. This

20 Jaap Scheerens . 2010. Teachers' Professional Development , Europe in international comparison . An analysis of teachers' professional development based on the OECD's Teaching and Learning International Survey (TALIS)

also enables the teacher to make new connections within the subject and across subjects.

In the current digital society with vast amounts of information being available, the skills of connecting these various elements of information and making meaning out of them would need to be one of the primary focus areas of the teaching learning processes. Mind maps which allow for an idea to be explored in a non-hierarchical manner will be a very useful tool to structure the learning in a topic or idea. By using a public educational tool Freemind to build concept maps we open up possibilities to think beyond a specific hierarchy or in any particular sequence.

Concept map on 'Light' prepared by a teacher



Teachers can use mind maps to initially design their own lesson plans, bringing out the linkages between the topic and other topics and sub topics. This can help them broaden their own understanding as well as communicate their thinking easily to fellow teachers and students.

12.1.2 Developing a topic for the classroom

Once the concept map establishes the contours of the scope of the topic, the classroom experiences can be structured keeping in mind the cognitive development stages. It needs to be recognized that the learning outcomes are not just factual. Several works of research have shown that learners continually construct knowledge using the various inputs available to them; the social environment of the school and the community is also a major contributor to the learning. It is therefore, important to structure the learning experiences in terms of the cognitive development and ability of the child. One of the basic ideas here is that the content is only a vehicle for achieving learning outcomes. We want to look at why we are teaching a topic and how to teach it. These questions have to be asked and answered in all subject areas.

12.1.3 Learning Outcomes

Learning outcomes are not only content based (factual; can be learned by rote). They can be broken into ***conceptual learning***, ***skill learning*** and the ***content/knowledge learning***. The content/knowledge learning part pertains to the factual components, various definitions, procedural knowledge, theories, etc.

Concept Learning/Idea to be Conveyed:

Concept learning outcomes look at what are the key discipline ideas in a topic or theme. These allow the children to make a structure for their learning and help them become continuous, life-long learners. They learn to abstract, get to the core meaning and build upon that core understanding. These concepts will be built according to the age of the student (NCF calls this cognitive validity). For the teacher, a good way to define a conceptual outcome is to ask this question : " 20 years from now; the student will forget all these definitions, formulae – what is the key idea (s) that I want them to remember ."

Skill Learning

Skills are cognitive, psycho-motor, linguistic and social abilities that are built over a learning period. The skills can be directly related to the topic. In this case, these will be called the applications of the concept/ idea/ content. For example, building a dynamo or fixing a bulb or recording an experiment are directly connected to the lesson being taught. But every lesson also has higher order skills which are important to develop. For example, learning to observe carefully and accurately or safety precautions around electricity are also skills that can be developed.

Multiple skills can be developed through one topic/ theme. More than one topic can also be for addressing one skill.

Knowledge Learning

The content/knowledge learning part pertains to the factual components, various definitions, procedural knowledge, theories, etc. These form the basis for further study in a particular area. It is interesting to recognise that while the key knowledge idea may be the same, the building of the conceptual layers of understanding will allow a topic to move from simple levels of understanding to more and more comprehensive levels.

12.1.4 Activity based learning

Activities can be designed carefully to achieve all these learning outcomes above. The effectiveness of an activity is in terms of the linkages the teacher is able to provide to the topic being discussed and in relating to the learners' context and methods to evaluate if an activity has achieved its objectives. These activities can be in the form of group work, individual hands-on work, computer aided tools and simulations, audio-visual equipments, reading and classroom discussions and questions.

Now that we have explored the general framework for developing curriculum, we will look at specific subject areas.

13 Subgroup # Science

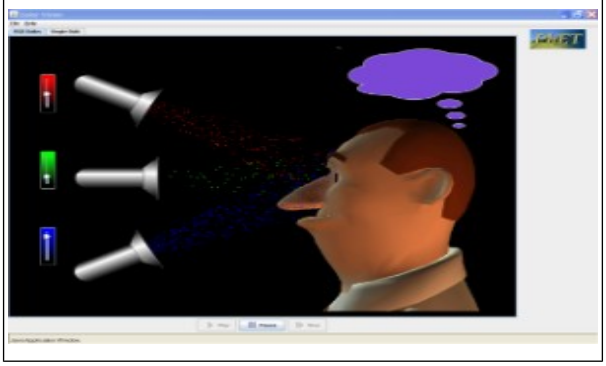
Science learning is about building experiences that will allow for observation, experimentation, recording, analysis and understanding of the various phenomena around us. As outlined in the NCF 2005 position paper on science, there are various factors to be kept in mind for effective teaching-learning practices for science. These include the social context of the students, the prior knowledge and the conceptions they have about phenomena around them (these could be accurate or inaccurate), the felicity in the use of language, availability of lab and learning resources. A good pedagogy must allow for a judicious mix of several teaching learning methods including direct observation, inferences, instructions, reading and recording. The science curriculum should satisfy criteria of cognitive validity, content validity and contextual validity.

Experimenting and activity based learning has been recognized as one of the important methods of science learning and teaching. It is important that the activities be planned and designed in such a way as to build conceptual understanding besides the learning of facts. Activities must be designed so as to allow for constructivist learning possibilities. While open ended inquiry and observation have a role to play, there are several situations where direct observation is not possible, or physical experiments may be difficult to perform. Educational tools, including simulations can be used to supplement the learning experiences in these situations.

13.1.1 PhET

PhET is a tool that has several science simulations already built-in. There are simulations in Physics, Chemistry and Biology. The power of this tool is that it is possible to simulate experiments that are difficult to perform. It is also very effective for analysing phenomena that occur. For instance, it is possible to simulate the nuclear reactions, the phenomenon of electromagnetic induction and other advanced topics. PhET simulations can also be used to reinforce understanding of many primary and upper primary school concepts in science.

Illustration 1: PhET simulation - Color vision



After a class or during a classroom discussion, the teacher can use the simulation and lead the discussion. A simulation allows for many variables to be manipulated and the effects can be discussed.

13.1.2 Kalzium

Kalzium is a desktop computer application that can be used as a teaching aid for introducing various ideas in Chemistry – like the periodic table, molecular structure of elements, compounds, determination of formulae, the timeline of discovery of elements, structure of isotopes and determining equations.

13.1.3 KStars

KStars is a Desktop Planetarium for KDE. It provides an accurate graphical simulation of the night sky, from any location on Earth, at any date and time. The display includes upto 100 million stars, 13,000 deep sky objects,all 8 planets, the Sun and Moon, and thousands of comets and asteroids.

Illustration 2: Kalzium - Periodic Table of Elements

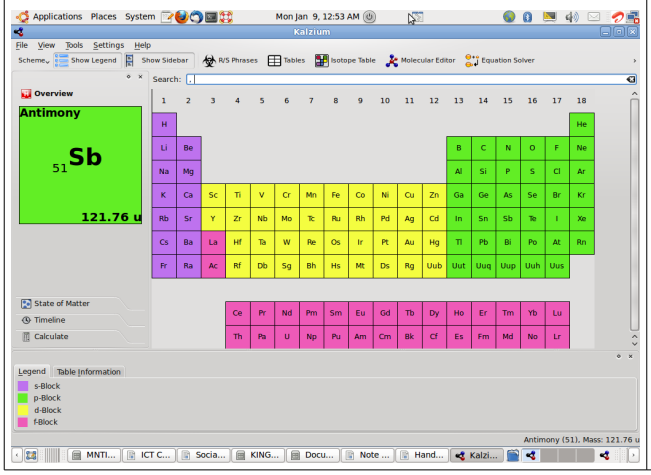
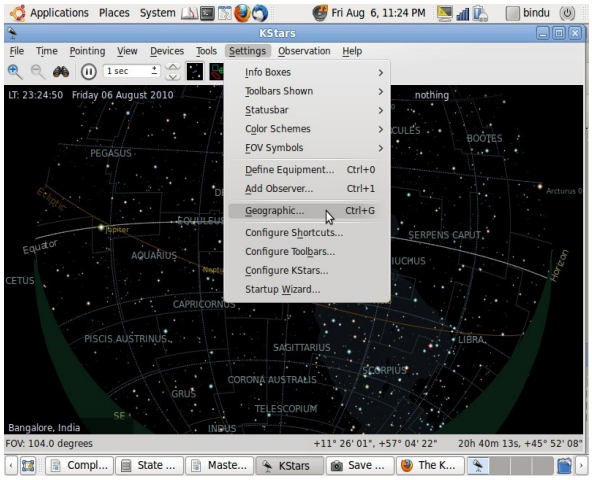


Illustration 3: KStars - Desktop Planetarium



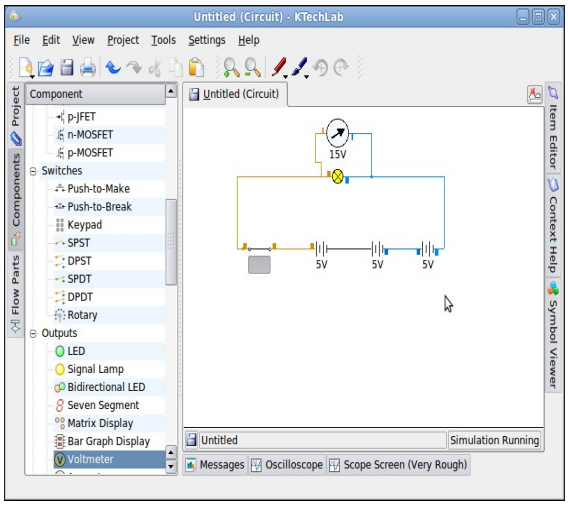
A similar application is Stellarium. Using both of these, the motion of planets and stars can be simulated and observed for any given location. Most astronomical observations are possible only at night time (except a solar eclipse) and this tool allows the teacher to explain the various phenomena that the student can observe at home. It is possible to create contextually relevant teaching-learning resources using these tools.

13.1.4 KTechLab

K Tech Lab is a free software which helps to make different types of circuits (electronic & electrical) and conduct experiments. Various electronic components like resistor, diode, switch,
transistor, micro controllers etc. can be run using this software.

Since it works in GUI mode, it is very easy to handle. The components required for electric circuits can be easily dragged into the work area using a mouse. When we join the pins using mouse, the circuit is formed. The properties of each component is displayed when bring the pointer above it. Students are not able to do some experiments which involve real devices and consumables, even in groups. But these experiments can be done in KTech Lab environment. Thus loss due to the damages and lack of consumables can be avoided. Using this software students can easily form the circuits and can repeat the experiments a number of times.

Illustration 4: KTechLab - Electrical Circuit



13.2 Videos

There are a large number of videos available on natural phenomena which can be downloaded from the Internet and shared with the students. Discussions can precede or follow the viewing based on the lesson plan of the teacher.

In order to dub videos in foreign accented english or foreign languages, the software 'recordMydesktop' can be used by teachers. This software can also be used to create simple videos using other software applications. For eg. A video on lunar eclipse was created by a science teacher (GMPS Yediyur) using 'recordMydesktop' and stellarium application.

13.3 Alternate text books

Analysing text books used in elementary education is a useful learning activity for student teachers. Along with the state text books, alternative text books such as those produced by NCERT, SCERT of Kerala, Delhi, as well as organisations like Ekalavya can be downloaded/ referred from the Internet. Comparing the way a topic is analysed in different text books would broaden the understanding and perspectives of the student teachers.

Similar text resources include the NCF 2005 position paper in social science[21].

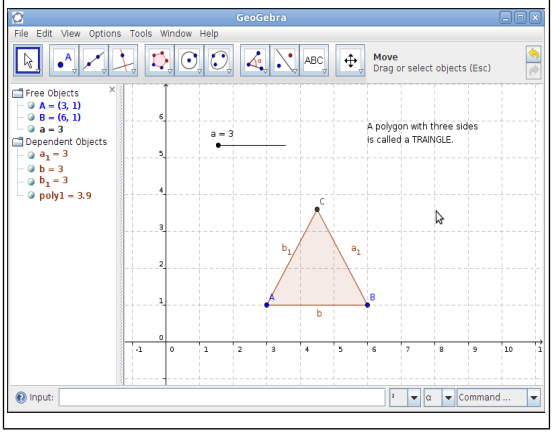
14 Subgroup # Mathematics

One of the key areas of focus of the NCF position paper of mathematics is the focus on higher order learning outcomes, involving conceptual understanding, using mathematics for problem solving as well as in estimation, mathematisation and mathematical communication. Many computer aided tools as well as web resources are available for use as resources that can be used towards these above learning outcomes.

14.1.1 Geogebra

Geogebra is a good example of a computer aided tool, which helps us in learning Geometry, Algebra and Calculus. Geogebra is a highly versatile and advanced learning tool available for use by mathematics teachers. This is a tool that can be used for clarifying concepts and also for linking aspects of mathematics – like algebra and geometry – which have always been taught as different topics. Using a graphics view, Geogebra can be used to stimulate a visual understanding of various concepts. Using this tool, several topics can also be explained in high school mathematics as well as physics. It is a free software, which functions in GNU Linux Operating System.

Illustration 5: Geogebra - Algebra and the Geometry View



Geogebra cannot replace children using the compass box to draw. The student-teachers in classes must use the compass box and pencils to draw and construct. This tool must be used by teachers to animate some concepts and theorems to enable them to use it as a teaching aid to further their own teaching methodologies.

In addition to Geogebra, simulations are available in PhET for arithmetic concepts.

14.1.2 Kturtle

Kturtle is another tool that is available for teaching logic. It can be used to visually represent the flow of logic in a programming sequence. Kturtle can also be used to visualize directions, angles in a pre-geometry way without getting into formal definitions of geometric terms.

21 Www.ncert.nic.in

Can make the concept of computer programming less intimidating for both teacher and student. In today's digital world, mathematics education may be seen as may areas of learning coming together. These parts are conceptual understanding of the mathematics , using the algorithms to internalize and apply the conceptual understanding pattern recognition and logical reasoning especially to understand theorems and proofs. K Turtle helps teachers build logical reasoning and pattern recognition with children. As it is visual, many geometric properties can also be understood through the use of K Turtle, like making the turtle draw a square requires the child to understand the properties of a square. Thus it is very useful to teach logical reasoning side by side with mathematics. This tool provides a interactive and easy method to do the same with children starting in the upper primary classes.

14.1.3 Videos and other internet resources – for Science and Math

Many good quality videos are available that can be used in the classrooms. There are several audio and video editing tools that are available using which the teachers can create videos in Kannada or provide contextually appropriate explanations for the videos. Many such videos can be found at Eureka. Many videos are also available on youtube.

In addition to these tools and specific videos, accessing the Internet and identifying good quality learning resources is very important. It is important that these resources need to be contextually relevant, accurate and easy to understand. Some examples of good quality educational websites are the following:

www.physicsclassroom.com, www.ceeindia.org, www.nsta.org, www.arvindguptatoys.com, http://plus.maths.org/content/, www.nsdl.org, www.khanacademy.org, www.coreknowledge.org, www.nctm.org

15 Subgroup # Social Sciences

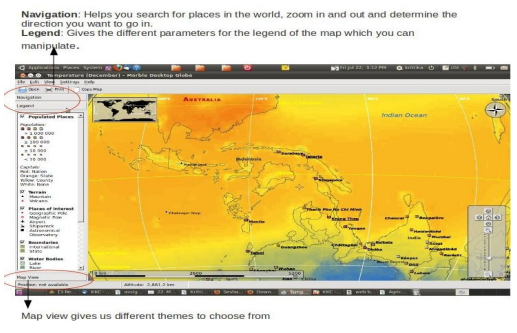
There are several issues in the teaching – learning of social sciences that impact the learning outcomes. Social sciences is largely perceived as a body of facts with very little relevance to the life of the student. In a pluralistic society like India, local context and content is vital in the classroom transactions in social sciences. Social sciences also carry the unique position of being able to look at normative issues of the society. The imperative for creation of local content is very high – whether through photo stories or audio-visual recordings of the community. Through easily available desktop video and audio editing tools, such as Audacity and Desktop Recorder, teachers can create content that would be most appropriate for their classroom setting. Digital technology also allows teachers to prepare contextual resources keeping in mind their student's background. It also offers possibilities of addressing the normative responsibility of the discipline towards social justice and equity.

The social science curriculum is vast and by its nature must involve transactions with and understanding of the outside world. The curriculum covers different issues of society through the disciplines of geography, history, political science etc. The world wide web is a useful space to gather information and methods for understanding and teaching these various issues.

15.1.1 Kgeography and Marble

Public software educational tools such as KGeography and Marble allow children to explore different kinds of maps and help them form a visual representation of different places. KGeography is a Geography educational tool to explore maps by continents, countries etc. Children can also explore states, their capitals, flags of each country and test themselves in it. Marble is like a desktop Atlas that can be used to learn more about the Earth. You can zoom in and out looking at different places in the world. This is a useful tool to explain longitude, latitude and seasonal differences. We can also use Marble to look at the earth at different points of time – thus integrating

Illustration 6: Marble - Desktop Atlas



history with geography.
These two tools are available on the Ubuntu desktop and do not require an Internet connection. Google Earth is another application that can be downloaded and used to explore different geography phenomenon. Other interesting online map tools include Google maps http://maps.google.com/ and Open Street maps http://www.openstreetmap.org/. Both these maps can be edited; local spaces can be added and shared with everyone.

15.2 Videos

There are a large number of videos available on social phenomena which can be downloaded from the Internet and shared with the students. Discussions can precede or follow the viewing based on the lesson plan of the teacher. In order to dub videos in foreign accented english or foreign languages, the software 'recordMydesktop' can be used by teachers. This software can also be useha d to create simple videos using other software applications. For eg. A video on lunar eclipse was created by a science teacher (GMPS Yediyur) using 'recordMydesktop' and stellarium application[22].

In social sciences, there should be plenty of projects that require the student-teachers to prepare small video clips on relevant topics – this has great potential to capture historic sites, geographic features as well as interactions of citizens and communities in civic activities. Cultural aspects too are valuable to capture – dance forms in Karnataka, different languages/dialects being spoken all are worthy of being captured on videos. Interested student-teachers can also learn simple video editing tools like KDENLIVE to create meaningful clips

15.3 Alternate text books

Analysing text books used in elementary education is a useful learning activity for student teachers. Along with the state text books, alternative text books such as those produced by NCERT, SCERT of Kerala, Delhi, as well as organisations like Ekalavya can be downloaded/ referred from the Internet. Comparing the way a topic is analysed in different text books would broaden the understanding and perspectives of the student teachers. Similar text resources include the NCF 2005 position paper in social science.

15.4 Project work

Project work is an important method of learning in social sciences, student teachers can be encouraged to work in small groups on a variety of topics in history, geography, political science, economics, for which they could download existing information from the Internet, form connections and linkages with the local and create interpretations and analyses of the topic.

Such projects can also be used to discuss current issues of interest (such as global warming, or corruption or elections) and importance and make social sciences much more live and interesting.

16 Subgroup # Languages

Language is the medium through which we communicate with the world. English is now considered a global language and hence must be learnt by all. research shows that young children learn best thorough a language that is most familiar to them – their mother tongue. It is hence important for the teacher to remember the differences between English and Indian languages during teaching-learning processes and be able to connect the local language while teaching English. The internet provides a variety of language learning resources, including worksheets, audio-visual material etc. for this.

Illustration 7: KHangMan - Tool for learning English

22 Available on http://bangalore.KarnatakaEducation.org.in

16.1.1 English learning

Since English is considered a global language, it becomes crucial for students to learn the language and build their vocabulary in it. Public software educational tools such as Gcompris and Childsplay help children learn basic alphabets and simple English words. KHangman and KAnagram are more advanced public software educational tools which are useful to further build children's vocabulary. Along with the existing list of words, teachers can also add new ones, provide hints in Kannada, depending on the capabilities of their students. These tools are available on the Ubuntu desktop.

16.1.2 Internet as a learning resource – Social Sciences and English

There are plenty of websites with information on various social science issues. Some good websites include http://kids.nationalgeographic.com/kids/, http://www.bbc.co.uk/history/forkids/ etc. Online encyclopedias such as www.wikipedia.org and www.kn.wikipedia.org help teachers get information on almost any topic that they are looking for. They can also add information to this, collaborate with others and edit information on these sites. Similarly http://wikieducator.org/Main_Page is a website for open educational resources which can be commented on and shared by all. Online magazines such as http://www.teacherplus.org/ provide interesting articles written by teachers on different issues. Online book web sites such as http://books.google.com/ offer free books on many issues. NCERT textbooks are also available online at http://ncertbooks.prashanthellina.com/.

Websites such as http://digitaljournalist.org/issue0309/lm_index.html and http://www.boston.com/bigpicture/ showcase photography from different places and time periods, which can be used by the teacher to initial classroom discussion. Digital cameras can also be used by the students to click relevant pictures to discuss in the classroom. In addition to photos, videos are available on website such as www.youtube.com and http://vimeo.com/. Teachers can also prepare their own slide-shows and videos using a simple digital camera. This can even be explored as project work for students. Tools such as recordmydesktop help teachers modify videos that are available on the Internet. It also allows them to make their own videos using their computer. As a social science class should involve learning about the world, online news website need to be an integral part of the classroom proceedings. Global news can be watched through websites like http://www.bbc.co.uk/ while Indian news can be accessed at http://ibnlive.in.com/agency/CNN-IBN.html, and http://www.ndtv.com/.

There are also available, on the internet, useful sites for learning Englishh: http://learnenglishkids.britishcouncil.org/en/, http://www.bbc.co.uk/worldservice/learningenglish/ and http://learnenglish.britishcouncil.org/en/. Organisations likehttp://www.clrindia.net/ , http://smilefoundationindia.org/ and http://prathambooks.org/ also offer good English resources for non-native speakers. In addition, there are plenty of online dictionaries which can be used to improve vocabulary, pronunciation and grammar. Some good ones include the Cambridge (http://dictionary.cambridge.org/) and Oxford (http://oxforddictionaries.com/) dictionaries.