

BANGLADESH: SECONDARY EDUCATION SECTOR INVESTMENT PROGRAM (SESIP)

L3047-BAN

TERMS OF REFERENCE

for

Development of e-learning Modules for Six Subjects (SD-13)

A. Program Background

1. The Secondary Education Sector Investment Program (SESIP) was approved by Asian Development Bank's Board on 27 September 2013. Periodic Financing Request 1 (Tranche 1) for \$90 million (2013–2017) was approved by the ADB President on 21 October 2013. The loan became effective on 06 December 2013. The government's Development Program Proposal (DPP) was approved by the Executive Committee of the National Economic Council on 29 October 2013.

2. SESIP supports secondary education in Bangladesh over 10 years, using a multi tranche financing facility (2013–2022). SESIP will support the implementation of key reforms envisaged in the National Education Policy (NEP), 2010 in a phased manner. The MOE has approved a 10-year Secondary Education Sector Road Map for implementation of the NEP. SESIP will also adopt a sector-wide approach that supports a government-led common secondary education program framework with enhanced harmonization of ADB and other development partner's assistance. The Ministry of Education (MOE) is the executing agency and the Directorate of Secondary and Higher Education (DSHE) is the implementing agency.

3. Under Output 1.1. "Improved Relevance and Quality of Curriculum", E-learning modules will be developed for six core subjects (Bangla, English, Mathematics, Science, Bangladesh Global Studies and ICT) to support ICT Learning Centers (ILCs) that will be piloted in 640 schools for 6,400 teachers. A total of 6,400 teachers and 1,900 head teachers/madrasah supers will be trained on e-learning, 5,000 of them on the use of ICT for pedagogy. Overseas training for e-learning capacity development will also be provided under SESIP.

4. Other relevant e-learning activities have been completed or are being implemented by Teaching Quality in Secondary Education (TQI I), Secondary Education Quality and Access Enhancement Project (SEQAEP), British Council, English in Action, Primary Education Development Program (PEDP) II and III, Access to Information (A2I) and BRAC Education Program to mention a few. Consultation with TQI II is especially important as they are planning to develop e-learning materials for Grade 6 on 16 subjects and also for Grades 9 and 10.

5. NCTB is the main co-implementing partner to work closely together with. Also the DSHE Training Wing and local entities like TTCs are important partners when it comes to training and continuous professional development of teacher trainers, teachers and administrators in the field. DSHE Secondary Wing and M&E Wing will be implementing partners for monitoring.

B. Purpose and Objective of the Assignment

5. The purpose of this Service Package SD-13, under Tranche 1 financing, is to have interactive digital teaching and learning materials, referred to as “e-learning materials” or “e-learning resources”, in a modular form, to be developed, supplied, and user-oriented for six selected subjects targeting grades 7-8 of secondary education. The subjects to be covered in the modules are: Bangla, English, Mathematics, Science, Bangladesh Global Studies and ICT.

6. The overall objective of the work is to have available materials in digital form that are expected to be accessed from the internet or through other channels like mobile phones, local computers, or other devices by teachers, students, and other potential users. There must be provision for the materials to be downloaded onto a PC, Tablet PC, Mobile or other electronic devices and used offline, and there be sufficient orientation - through a modality to be determined - by the firm of the users of the 640 SESIP ICT Learning Centers to be installed. The orientation will include ICT and pedagogy. It is acceptable for appropriate materials to be accessible from a local server via a browser.

7. The expected outcome of the work is that Web-based materials are available and pedagogically appropriately used in all schools that have access to the internet, or to a Local Area network (LAN) or other provider and have available IT classrooms.

C. Implementation Arrangements.

8. A firm/organization will be engaged through National Competitive Bidding (NCB) by Directorate of Secondary and Higher Education (DSHE) on open tender using Quality and Cost-based Selection – Full Technical Proposal (QCBS-FTP) to undertake the module development. The firm will support SESIP with assistance and coordination from the SESIP Sector Program Support Unit (SPSU) and consultant staff. Main counterparts are NCTB, Team Leader and Deputy Team Leader of SESIP and the International and National e-learning Specialists. Other consultants will support as needed.

8. The modules will be developed from scripts, based on approved curriculum and textbooks. Some materials like photos, video clips, animations can be obtained from other public sources in order to enrich the presentations. These will be aligned with the curriculum. The modules have to be developed as a first phase by the firm, in collaboration with NCTB curriculum specialists, with the participation of stakeholders and the approval of NCTB. The script development and validation process is hereafter referred to as Phase 1. The firm/organization selected will also be responsible for Phase 2, the development of the actual e-learning modules and orientation training approach and training of Core Trainers. In Phase 2, the firm will also work with/keep informed as determined and needed, the Director of Secondary, and Director of Training, in the Directorate of Secondary and Higher Education (DSHE), in coordination with the SPSU. The firm will help to build capacity of NCTB and relevant DSHE officials as an outcome.

9. The duration of the consultancy will be for a total of 12 months, with roughly six months allocation for each phase. The location of the assignment will be Dhaka with occasional field visits. The Consultant firm will provide their own facilities for carrying out the work. Some temporary working space will be arranged also for counterparts from NCTB or SESIP when/if working with the Consultant. Individuals of the firm team members will visit NCTB as needed, and adequate work space will be provided in NCTB, if needed.

10. In terms of scope of work, a teacher centric development approach might be considered; where students, parents, school management committee will be the subsequent level beneficiaries.

11. The scope of work includes, but is not limited to, the following elements:

e-learning content/module:

- Develop e-learning modules on six subject matters for teachers and students (Science, Maths, English, Bangla, Bangladesh Global Studies, and ICT);
- Create a web based solution/platform to upload the e-learning module, and;
- Create web based platform to share materials among schools, such as ideas and best practices.

Integrated solutions design for schools:

- Create web based solution/platform to perform students' performance assessment and automation of school management activities;
- Develop physical and web based technical support solutions/platform with ticketing system and hotline facilities for schools to make the lab functional;
- Make a real-time monitoring dashboard, and;
- Arrange ToT for 40 Core Trainers on ICT basic literacy, and application of e-module and web/mobile based solutions.

Sustainability design:

- Design and execute sustainability plan (business model development) of the initiative since beginning to ensure continuation of such service even after phasing out the project.

D. Scope of the Service

12. The activities to be covered under the scope of the review are:

- a. During Phase 1, the consultant's team members will work with experts appointed by SESIP, comprising experts covering teaching/learning methodology, experts covering the six subjects, e-learning experts, textbook specialists, animation specialists etc. This group of experts, mainly from NCTB and Government Teacher Training Colleges (including consultants engaged by SESIP), will determine what is pedagogically sound, and safeguard that the script content for the modules covers the core areas of the curriculum. NCTB will be in charge of coordinating the expert group and see that they are available to work with the firm/organization. NCTB will also be responsible for quality assurance of the scripts. The consultant's Team Leader will be responsible for coordination with TQI II for linking with the e-learning material development for Grade 6 (and other grades) that will be implemented under TQI II. The SESIP Team Leader and Deputy Team Leader may also introduce the firm to relevant contact persons in other ongoing projects;
- b. The roles and responsibilities of NCTB during implementation of Phase 2, which covers the development and dissemination of the actual e-learning modules, will be mainly related to quality assurance and providing final approval of the modules;

- c. The roles and responsibilities for DSHE Secondary, Training and M&E Wings during implementation of Phase 2 will be determined during implementation, and mainly be related to e-learning module implementation and monitoring of use and training;
- d. The contracted firm/organization will develop or acquire all resources such as photographs, diagrams, video, animations/simulations, etc., using their own facilities. They must have the required equipment and laboratory facilities. Issues related to Copyright have to be clarified at all stages of the work;
- e. All e-learning modules must be relevant to Bangladesh customs and culture and the language must be Bangla, except when the subject is English language. The materials must be free from gender or ethnic bias;
- f. The modules, being web-based, will be available for use by all secondary level educational institutions in Bangladesh, keeping in mind the 20 networked laptop plus school-based server configuration of the 640 ICT Learning Centers (ILC) to be installed under SESIP, and;
- g. The firm/organization must deliver an editable form of the final versions of all modules and related resources to make it possible for DSHE to update and amend them as desired by MOE. The copyright will be with MOE.

13. The sources of information are:

- a. The latest version of the Bangladesh Secondary Education Curriculum and textbooks, especially Grades 6-10 core subjects (Science, Math, English, Global Studies, Bangla and ICT);
- b. Different web based sources of information. Note that these sources should be used with caution to avoid any copyright conflicts or use of material that is not fitting the local context, and;
- c. Other relevant sources of information available with MoE and DSHE may be used.

14. An Inception Report will be presented by the firm/organization before the end of the first month, comprising any changes proposed to the TOR, a detailed time plan and milestones for deliverables. A mid-term report will be presented by the end of the sixth month with presentation of the status and results of the development of the scripts and draft modules, including discussion about any shortcomings.

15. The following specific activities will be undertaken:

- a. Phase 1, including: collecting and scrutinizing all relevant documentation from SESIP background documents, NCTB materials including curricula and textbooks, TQI I and II, SEQAEP, EIA, A2I, PEDP III etc. and other available sources; developing strategy for script development, approach and tools (to be approved by SPSU and SESIP Team Leader); development of scripts together with teams of NCTB experts and SESIP Specialists; testing the scripts by presenting the texts in a few classrooms, including all grades;
- b. Prepare a brief mid-term report describing the work carried out so far, with findings and recommendations in case of any shortcomings, and with copies of the scripts annexed;
- c. Regularly discuss progress, mostly informally, with NCTB, DSHE, SPSU, and SESIP Team Leader;

- d. Phase 2, including: developing the actual e-learning modules and testing their functionality through various modes of delivery; present the modules for NCTB and selected representatives from other relevant entities and collect feedback; present/pilot the modules in minimum 20 classrooms in at least one rural and one urban school selected from among the 640 pilot schools; discuss with students, teachers, Head Teacher and other relevant staff and School Committee members, parents, PTA etc in order to collect relevant feedback;
- e. The e-learning modules will also be presented in a session for DSHE and NCTB experts for their comments. Representatives from TQI II, EIA, PEDP III and other relevant projects should also be invited;
- f. Phase 2 will also include desk work: analysis of collected feedback and comments; incorporation of comments into final draft versions of modules; present the modules for NCTB for final comments and approval;
- g. Provide e-learning module dissemination and orientation through a proposed modality that includes scope of use, pedagogy, assessment, and other learning- and school-related uses;
- h. Preparation of Draft Final Report with findings, recommendations and justifications for any proposed changes. All materials should be annexed, where possible on DVDs and/or with links to web pages, and;
- i. Presentation of the Final Report, incorporating any comments on the draft report.

E. Consultant Requirements:

Positions (all national)	Estimated Person-Months
Team Leader/Project Manager	12
e-learning Specialist	8
Curriculum/ICT in Education Specialist	8
Web design/ICT specialist	6
Graphic design specialist	4
Audio/Video expert	2
User Experience Designer	3
Quality Assurance Specialist	3
Mobile App Developer	6
Total	52 months

16. The eligibility of the firm is described below. The firm/organization must have:
1. 5 years-experience on designing a) digital education content, b) mobile app and web solutions;
 2. A track record and in-house expertise on digital content development including education sector;
 3. In-house expertise to design and implement web/mobile based connectivity solutions between school management and the parents;
 4. Experience on designing web based fast-track technical support platform with ticketing system for ensuring quick solutions of technical problems to the computer labs;
 5. Proven experience on designing and implementing real-time monitoring dashboard for tracking the performance of an initiative;
 6. In-house expertise on mobile app and web solutions development;
 7. In-house pedagogy and ToT expertise and experience on basic ICT literacy and core skills on digital literacy, and;
 8. The selected firm must have experience on designing business models to propose initiative for sustainable solutions.
17. Qualifications and Experience of the individual experts and related tasks are as follows:

i. Team Leader/Project Manager: national: Twelve (12) months

Qualification and Experience:

Minimum Master's Degree, preferably in Education, from a recognized University, having 10 years of experience in Project Management with emphasis on the Education Sector, of which five years in development partner funded projects/programs.

Tasks:

The main task of the consultancy assignment is to provide high quality and relevant e-learning materials. Therefore the TL will lead, guide and support the team with necessary oversight for all related activities including undertaking exchange of views and sharing information with other experts of the program and representatives of the Client. The tasks, among others, will include effective planning, management, coordination and reporting of all work.

The detailed tasks shall be:

- (i) establish the team, coordinate, and monitor communication with specialists and counterparts from DSHE and NCTB as well as other players for accessing and collecting all the relevant background data;
- (ii) prepare plan and timetable for the work related to Phase 1;
- (iii) guide, monitor and supervise the team in the development of the scripts;
 - (iv) under Phase 2, guide the team and contribute to the development of the e-learning modules on the six subjects;
- (iv) ensure quality of all outputs;
- (v) provide oversight and monitor the progress of all material development;

- (vi) participate in meetings, and;
- (vii) prepare inception and progress reports.

ii. Senior E-learning Specialist, national, eight (8) months

Qualification and Experience:

Minimum Master's Degree in Education from a recognized University. Minimum 10 years of experience in teaching/learning material development in the Education Sector; of which five years in relation to interactive e-learning materials. Three years of experience in Development Partner funded projects/programs. Experience from carrying out minimum one assignment in developing e-learning interactive materials for the Secondary Education level would be an asset.

Tasks:

The e-learning Specialist will assist the Team Leader in leading the team throughout the development of the scripts and the e-learning modules with specific expertise in e-learning, including undertaking exchange of views and sharing information with other experts, organizations and representatives of the Client. The tasks include overall responsibility for the pedagogical aspects of the materials and approaches and coordination of the delivery of inputs during Phase 2.

The detailed tasks shall be;

- (i) assist in establishing the team, communication with specialists and counterparts from DSHE and NCTB for smooth implementation of the script writing work;
- (ii) prepare, together with TL, the Curriculum Specialist and the team, concrete outlines, templates and pedagogical approach for the modules;
- (iii) secure compatibility with the curriculum and suggest common approaches and templates;
- (iv) guide the team, especially in understanding specific e-learning modalities to keep in mind;
- (v) take responsibility of selected content development as one of the team members;
- (vi) ensure pedagogical quality of the outputs;
- (vii) participate in the piloting of the modules in a selected number of schools;
- (viii) participate in meetings and assist TL in preparation of reports, and
- (ix) carry out any other duty as required by the Team Leader.

iii. Curriculum Specialist, National, eight (8) months

Qualification and Experience:

Minimum Bachelor's Degree in Education or related field from a recognized University, having at least 5 years' experience working with development of the new curriculum, including assessment, for Secondary Education in Bangladesh. Experience with material development is required.

Tasks:

The Specialist will closely analyze the approved national curriculum, especially for the five core subjects and ICT, and propose how to arrange the content according to the suitability for presentation in e-learning module electronic form. He/she will be in charge of collection of all content and arrangement.

The detailed tasks are:

- (i) in close collaboration with NCTB and the e-learning Specialist, collect the relevant curriculum material;
- (ii) secure compatibility with the curriculum and suggest common approaches and templates;
- (iii) guide the team, especially in understanding specific minimum content modalities to keep in mind;
- (iv) take responsibility of selected content development as one of the team members; (v) ensure pedagogical quality of the outputs;
- (v) plan and implement the piloting of the e-learning modules in a selected sample of schools;
- (vi) participate in meetings and assist TL in preparation of reports, and
- (vii) carry out any other duty as required by the Team Leader.

iv. Web Design/ICT Specialist, national, six (6) months

Qualification and Experience:

Minimum Bachelor's Degree in Computer Sciences or related field, having at least 5 years' working experience in developing web sites in relation to the education sector in Bangladesh. Experience from working with development projects or programs would be an asset. Experience in system architecture design for education sector desirable.

Tasks:

The Specialist will be in charge of guaranteeing that the requirements for presentation of the e-learning modules through various electronic media channels, mainly on a web page, are understood and considered by the team. The specialist will review available system architecture and discuss the work with the e-learning and Curriculum Specialists and the Team Leader and relevant NCTB and SESIP consultants.

Specific tasks are:

- (i) contribute to the development of the approach and templates for the e-learning modules;
- (ii) develop the web site for presentation of the e-learning modules;
- (iii) develop approaches for other modes of delivery, like tablets, mobile phones etc.;
- (iv) participate in any training of NCTB staff for updating the modules;
- (v) participate in the piloting in a few schools to get immediate feedback on possible technical glitches;
- (vi) participate in the analyzing the results from the field phase;
- (vii) assist the Team Leader in preparing the reports, especially with regards to technical content regarding the web site, and;
- (viii) carry out any other duties given by the Team Leader.

v. Graphic Designer, national, four (4) months

Qualification and Experience:

Minimum Diploma in Graphic Design or related field, having at least 5 years' working experience in preparation of designs for education materials and 3 years of experience in developing graphics for web based education materials in Bangladesh. Experience from working with design of textbooks related to the new Secondary Education curriculum would be an asset.

Tasks:

The Specialist will be in charge of developing visual elements like simulations, animations, graphs etc for the modules.

Specific tasks will be related to:

- (i) contributing to developing the template for the modules with the other team members;
- (ii) study visual elements used in the curricula and textbooks and other e-learning materials;
- (iii) develop all visual elements for the modules in close cooperation with the audio/video expert, and;
- (iv) carry out other duties given by the Team Leader.

vi. Audio/Video Specialist, national, two (2) months

Qualification and Experience:

Minimum Diploma in a related field, having at least 5 years' working experience in preparation of live and audio material for education purposes, especially for use on the web. Experience from working with producing audio/video content for education purposes would be an asset.

Tasks:

The Specialist will:

- (i) study video/auditory elements used in relation to presenting the new curricula and textbooks, especially e-learning materials;
- (ii) develop the video/auditory elements for the modules in close cooperation with the Graphic Design and other Specialists, and;
- (iii) carry out other duties given by the Team Leader.

vii. User Experience Designer, national, three (3) months

Qualification and Experience:

Minimum BSc in Interaction Design from any reputed university or vendor certification in relevant subject. Professional training on UX Designing is preferable. Demonstrating a strong visual design portfolio; strong proficiency in verbal, written, and presentation communication, as well as demonstrated success working in a multi-disciplinary team.

Minimum 3 years professional experience designing web-based and/or mobile products, sites, or applications;

Tasks:

The Specialist will:

- (i) Implement user-centered design methods and/or design-thinking throughout the product development life cycle;

- (ii) Ensure UX design is designed with functions to be used by the end user in mind;
- (iii) Quickly and thoroughly create interaction flows, wireframes, and mockups to effectively conceptualize product initiatives;
- (iv) Apply a data driven approach to all design activities;
- (v) Present design solutions and project deliverables to clients teams professionally;
- (vi) Write style guides capturing all design elements for proper life cycle management;
- (vii) Perform usability audits, recommend modifications for improvements, document results, measure and track progress on improvements as needed;
- (viii) Perform metrics analysis to inform design/UX optimization efforts;
- (ix) Relentlessly simplify and distill complex processes into intuitive and elegant UIs, and;
- (x) Lead user experience research and testing processes

viii. Quality Assurance Specialist, national, three (3) months

Qualification and Experience:

Minimum BSc or MSc in Computer Science and Engineering/relevant subject from any reputed university or vendor certification in relevant subject. Professional training on software testing is preferable and demonstrated strong understanding of SDLC and STLC methodology, skills in JAVA, C++, MySQL, J2EE, .NET etc.

At least 2-3 years professional work experience in software testing role.

Tasks:

The Quality Assurance Specialist will be responsible for software test planning, scripting and execution for a variety of applications as well as established standards under existing technological platform:

- (i) Prepare the test plan;
- (ii) Review the software requirements, get clarifications about the requirements;
- (iii) Familiarize with the software under test and any other software related to it;
- (iv) Generate test cases based on the requirements and other documents;
- (v) Create test data required for testing;
- (vi) Set up the required test beds (hardware, software and network);
- (vii) Test software releases by executing assigned tests (manual and/ or automated);
- (viii) Report defects (usually in a defect database) to the stakeholders;
- (ix) Create test logs;
- (x) Report test results to the stakeholders;
- (xi) Reply to returned bug reports (for example, when a bug report is returned as not reproducible);
- (xii) Re-test resolved defects;
- (xiii) Update test cases based on the discovered defects;
- (xiv) Provide inputs to the team in order to improve the test process, and;

- (xv) Be up-to-date on the overview of the development technology, generally used testing tools (e.g. automated testing tools and test management systems) and the overview of the business domain.

ix. Mobile App Developer, national, six (6) months

Qualification and Experience:

BSc or MSc in Computer Science and Engineering/relevant subject from any reputed university or vendor certification in relevant subject. Professional training on android development is preferable. Demonstrating strong OO design and programming skills in Java (J2EE/ J2ME), logical thinking and creative problem-solving ability. Demonstrating familiarity with the Android SDK, Android Studio and Eclipse.

Minimum 2-3 years of professional experience in data-driven mobile application development.

Tasks:

The Specialist will be responsible for the development and maintenance of applications aimed at a vast number of diverse Android devices. Primary focus of this position will be the development of Android applications and their integration with back-end services. The candidate will be working along-side other engineers and developers working on different layers of the infrastructure. Tasks include:

- (i) Design and build advanced applications for the Android platform;
- (ii) Collaboration with cross-functional teams to define, design, and ship new features;.
- (iii) Gather requirements around functionality and translate those requirements into elegant functional solutions;
- (iv) Build prototypes at tech scoping stage of projects;
- (v) Working along the web developers to create and maintain a robust framework to support the apps;
- (vi) Work with outside data sources and API's;
- (vii) Unit-test code for robustness, including edge cases, usability, and general reliability;
- (viii) Work on bug fixing and improving application performance;
- (ix) Continuously discover, evaluate, and implement new technologies to maximize development efficiency, and;
- (x) Carry out any other tasks assigned by the supervisor.

F. Deliverables.

18. The Consultant Firm/Organization shall deliver the following reports:

- (i) Inception report with updated work plan and detailed script development plan and specifications of all software and hardware platforms to be used: In the 4th week of the assignment;
- (ii) Mid-term report covering Phase 1, including the scripts for the modules: In the 6th month of the assignment;

- (iv) Draft Final Report: In the 11th month of the assignment, including the e-learning modules, and;
- (v) Final Report: In the last week of the 12th month of the assignment, including all materials, scripts and modules in editable form, and the Dashboard (described in Annex 1).

19. Examples of the types of e-learning materials to be considered are presented in Annex 1.

G. Client's Inputs

- a. The Client, through NCTB, will provide overall coordination of the team of experts that will work with the firm/organization, especially during Phase 1;
- b. The Client, with NCTB will make available counterpart personnel as described in Para 9;
- d. Access will be provided to all relevant information available with SESIP, DSHE and NCTB for the work

ANNEX 1, Types of e-learning materials to be considered for use in the modules

The materials will be based on the curriculum and text books, therefore each module will follow the textbook in terms of sync with the curriculum. However, it is intended that the interactive versions will feature a variety of styles of *multimedia*, in particular the types described below. Therefore, as stated earlier, scripts specifying multimedia items and their location in the subject material will be developed in close cooperation with NCTB during the first phase of the assignment. The actual modules will be developed, mainly by the firm's experts, during the second phase of the assignment, in cooperation with Training, Secondary and M&E Wings.

The modules will be used on computers (Table top PCs, laptops, tablets) and on mobile phone devices. They should be developed in a form that can also be downloaded on a server to be used in cases when/if internet is not available.

The firm/organization is encouraged to suggest the inclusion of the types of materials below, as long as these are agreed with the expert group.

Interactive simulations / animations

Simulations are an active representation of some system, process or phenomenon. For example, a simulation might model a beam of light entering a prism and being divided into the colors of the spectrum. The term *interactive* is used to indicate that the teacher or student can adjust certain elements of the simulation to change certain aspects of the of the simulated system. For example, a simulation of an electric circuit may enable the user to adjust the resistance of components in the circuit, add a switch or bulb, and so on. In such cases the behavior of the simulation must model the details of the system being studied. Simulations are most useful when accompanied by some simple interactive tests that students must answer to demonstrate that they have grasped the target knowledge and/or skills embodied in the simulation.

Animations are to graphics as videos are to photographs, and can show a dynamic representation in the way a photographic image or video cannot. For example, a diagrammatic animated cross section of a combustion engine can show the operation of the 4-stroke cycle. This is not possible to achieve through a video of a real engine. Animations must be used only when necessary to illustrate aspects of the topic. Animations for decorative purposes will not necessary support the understanding of the topic in question. Animations should normally be embedded in other objects, such as a presentation, and must be in a standard format, such as GIF and Flash.

Audio

Audio is particularly useful for subjects in which the spoken word has a significant role. Audio is a requirement mainly for the English subject. The TQI-II project uses audio materials developed by English in Action (EiA). EiA has free audio resources for many topics available for use. However, detailed study of the curriculum may reveal topics in other subjects for which audio has a useful role to play. In such cases it should be considered to use audio as one of the resources. Audio format should preferably be MP3 and must be playable in windows, Mac and Android systems.

Videos

Video should be used only when it is the best way to show something, usually a real world situation which cannot be represented in sufficient detail by a more abstract and cost-effective representation. The ability to pause and rewind can also very useful to teachers and learners. Video sequences should be no longer than is required to present the salient details of the topic. Video should be compressed as much as possible with sufficient quality being maintained and should be in a format which can also be viewed on mobile devices, such as MPEG 4.

Still images (photographic)

Like video, photographs will usually depict real life things and must be used only when necessary to the topic. Photographs used for decorative purposes will not have any added value in the materials. Photographs should be compressed as much as possible without sacrificing necessary image quality. They should be in a standard format, preferably JPEG.

Diagrams / graphs

Graphics are effective as illustrative tools for offering alternative representations of complex phenomena. A graphical image can show an abstraction presenting the details in an uncomplicated way. Diagrams and graphs should normally be embedded in other objects, such as a presentations. No specific additional software for viewing diagrams should be required.

Interactive tests for students

Interactive tests are such that the student takes the test on the computer or mobile device. Examples of test types that can be effectively represented interactively on a computer are:

- Fill in the blank
- Multiple choice click on answer (one correct answer or several graded answers)
- Multiple choice drag and drop answer
- Association of categories (objects are shown and the user must indicate in which one of several categories the object belongs)

Some properties that can be applied to all test types are:

- Timed version of test
- Repeated attempts allowed (perhaps up to a predetermined number of attempts)
- Scored / non scored
- Answer provided in case of unsuccessful attempt(s)

Tests can of course make use of multimedia, with any type of resource being used as questions and / or answers.

Combined resources ("Multimedia")

It is desirable that a given resource should feature a coordinated and interactive combination of several of the above types of resource.

Instructions for using a resource (when necessary)

Instructions specific to using a combined resource may be included in the resource itself. For example, a simulation may feature a button that the user clicks to access instructions on using the simulation. Any instructions necessary for using a particular resource must be available online and located so they can easily be accessed while using the resource itself.

Text

Text will usually be part of another resource (a simulation, for example, may feature text, while a diagram may have text labels and notes). Since text is fundamental to many resources its design for usability must be considered when creating e-learning resources. The following guidelines apply to the design of text:

- maintain a high color contrast between text and background
- keep text as brief as possible, using bullet point format when applicable
- use consistent and neat bulleting and indentation styles
- use fonts that are readable when presented on a screen if the text is to be used in a presentation and ensure that it can be seen from all parts of a typical sized classroom
- avoid overuse of multiple fonts and styles

Teaching / Learning Considerations

All material should be *interactive*, *when appropriate*, and primarily for students to use, in self-paced exploratory learning. Teachers, will of course have access to the resources but it is not the aim here to promote the use of the resources as an aid to classroom teaching. The modules are primarily meant to *replace* other teaching / learning modalities for certain selected parts of the curricula. .

Dashboard

An on screen “dashboard” should be included from where all the resources can be accessed. The materials for all subjects should be accessible from the dashboard. It should have a catalogue of what e-resources are available, preferably arranged by subject, grade and units within the subject and lesson; i.e. one for each textbook of which parts have been presented as an interactive module. The ability of a user to search the resources and topics by keywords is essential. Each e-material should also have a record of attributes that will allow for more specific search.

Hardware and Software Platform

Though the system is web-based, it must also be such that it can be installed on a local server (or an external drive) if the school has one but does not have access to the internet. The system should run on Window 7 or later windows desktop OS for single user environment. Tablet PCs running windows or android or Mac (iPad) should be able to access the server material over Wi-Fi. Smartphones should be able to access over Wi-Fi.

Note that the firm/organization is not required to supply any equipment. The above configuration is available in the target schools and thus needs to be considered when developing the resources.