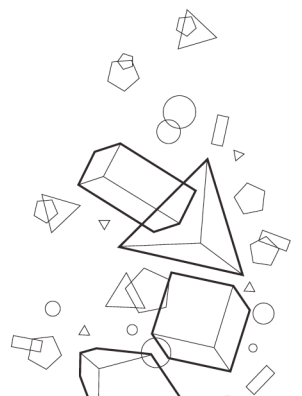


# Quality Criteria for Digital Learning Resources

An aid for teachers and others who want to evaluate the suitability of digital learning resources in educational contexts

Recommendations and requirements that are relevant for developers and purchasers



# Quality Criteria for Digital Learning resources

## Educational Aspects

### Introduction

Similar to other learning resources, digital learning resources are used in a variety of contexts, by different teachers, and for various purposes. This entails that a given resource can have an educational quality in one particular setting, though not necessarily in another setting. With this in mind, it might be more appropriate to define and clarify exactly what it is that should be evaluated, rather than to formulate quality requirements.

Many general quality areas pertain to all learning resources, regardless of whether or not they are digital. Elements such as structure, language, use of illustrations, and the type and scope of the learning assignments are important, independent of whether the resources are offered in a printed or digital form. The same applies to being aware of gender patterns, discrimination, objectivity, and representativeness. As much as possible, this document will eschew such general quality criteria for learning resources in favour of the elements that pertain specifically to digital learning resources.

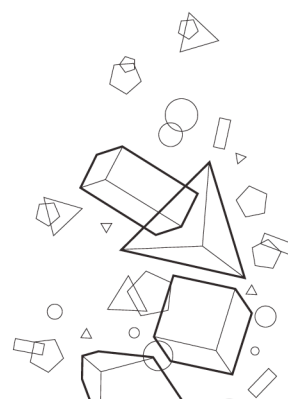
The result is that the evaluation criteria have been organized in three broad categories:

- **User dimension:** the interface between user and resource
- **The distinctiveness of the digital resource:** the possibilities and limitations of the digital resource
- **Subject and education dimension:** the educational and evaluation potential

The categories are defined by a set of key questions, a brief description, and a few



in-depth questions that are intended to promote reflection on the quality in the relevant areas. This means that this set of evaluation criteria has primarily been developed with an eye towards evaluating digital learning resources that already exist. The criteria might nevertheless also be useful for developers of digital learning resources, when their emphasis is on educational perspectives. Each evaluation category is summarized by a simple set of quality requirements that might serve as an aid for developers and purchasers.



## User orientation

### Does the digital learning resource create interest?

Description	In-depth questions
The resource <ul style="list-style-type: none"><li>• should help activate and motivate the pupils</li><li>• must be relevant to the subject being taught</li></ul>	a) What type of functionality helps create interest, and how does the design and layout contribute to this? b) How are images, graphics, video, sound, and so forth exploited to create interest? c) What choices have been made to ensure that the resource will promote learning and not merely activity and entertainment?

### Is the digital learning resource inclusive and accessible?

Description	In-depth questions
The resource should <ul style="list-style-type: none"><li>• be easy to use and as self-explanatory as possible</li><li>• follow familiar patterns for navigation and retrieval</li><li>• not exclude users on the basis of ethnic or social background or gender</li></ul>	a) How efficiently can the pupil start working on the subject matter (not waste time on navigation)? b) How does the resource enable as many as possible to use it (cf. the section concerning universal design in part 2)? c) To what extent can the resource be adapted to the individual pupil, and how is adequate differentiation facilitated? d) How can the pupils' media skills be utilized and developed?

### Quality requirements

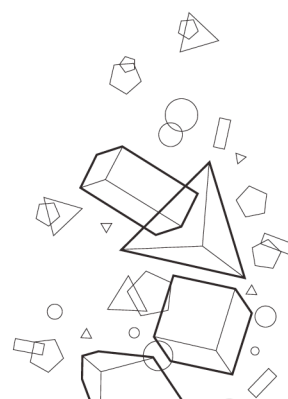
The learning resource enables individual differentiation

The learning resource uses the digital medium with the pupil's learning in mind

The learning resource addresses the target audience in an engaging manner

The learning resource has a universal design

The learning resource is self-explanatory



## *The distinctiveness of the digital resource*

### **How does the digital learning resource utilize the inherent possibilities of digital media?**

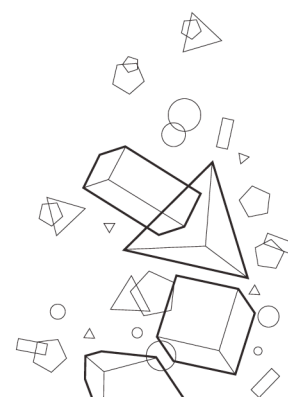
Description	In-depth questions
Resources should <ul style="list-style-type: none"><li>include various media forms such as text, images, video, animation, simulations, etc.</li><li>select and incorporate the media forms on an educational basis</li></ul>	a) In what ways can the user use a variety of media forms in the resource? b) How does interactivity (if such exists) help capture the pupils' interest in the subject? c) How is it ensured that the presented information is up to date?

### **Is the digital learning resource adaptable?**

Description	In-depth questions
The resource should <ul style="list-style-type: none"><li>be able to be adapted to different contexts</li><li>enable the use of individual components in different contexts (modular use)</li></ul>	a) How does the digital learning resource enable individual components to be used independently? b) To what degree does the resource allow the pupil to adapt the contents to his or her educational context?

### **How does the digital learning resource enable new educational possibilities that are lacking in traditional learning resources?**

Description	In-depth questions
The resource should <ul style="list-style-type: none"><li>facilitate a varied teaching and learning practice through<ul style="list-style-type: none"><li>the use of various media forms</li><li>the use of communication resources</li><li>solid access to updated information</li></ul></li></ul>	a) Does the resource enable communication between pupils, between teacher and pupil, and between others? b) How does the resource challenge the pupils in regard to the subject matter? c) To what degree are links provided to alternative sources and updated information? d) How are the specific capabilities of various media forms used in the learning work? e) To what degree is the resource innovative, and how can it help teach the subject matter?



## **Quality requirements**

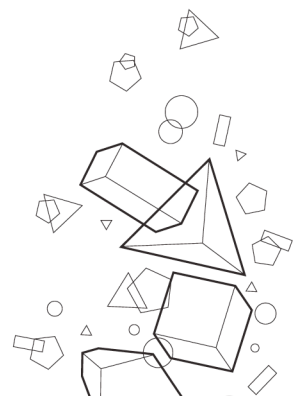
The learning resource enables interaction with the pupil

The learning resource uses communication to reinforce the learning work

The learning resource allows its contents to be updated

The learning resource is inspirational

The learning resource utilizes the specific capabilities of various media in the learning work



## Subject and education dimension

### How is the digital learning resource relevant for the curriculum?

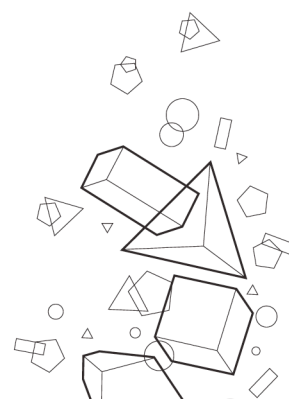
Description	In-depth questions
The resource should <ul style="list-style-type: none"><li>• be relevant for the current curriculum</li><li>• indicate how various goals in the curriculum are to be achieved</li></ul>	a) How is the learning resource relevant for the curriculum and the competence objectives? b) Is the learning resource suitable for achieving the goals that have been defined? c) Is the resource intended for a certain age or target group? How is it designed so as to reach any such target groups?

### Does the digital learning resource enable an evaluation that is adapted to the education setting?

Description	In-depth questions
The resources should <ul style="list-style-type: none"><li>• have built-in possibilities for evaluation, for example tests</li><li>• be able to be used for or be incorporated in formative and/or summative evaluation</li></ul>	a) To what degree does the resource support different forms of evaluation? b) To what extent does the resource enable the pupils to evaluate their own work themselves? c) How can the resource help the pupils to reflect following the evaluation? d) Does the resource allow the pupils to give feedback to and evaluate one another? e) How does the resource support the pupils in their further work following the evaluation (in the event of such an evaluation)?

### In which education settings is the digital learning resource suitable?

Description	In-depth questions
The resource should be suited for <ul style="list-style-type: none"><li>• individual work</li><li>• teacher-led activity</li><li>• group work, etc.</li></ul> The resource should <ul style="list-style-type: none"><li>• contain a teacher guide</li></ul>	a) How does the digital learning resource facilitate use in a variety of learning contexts? b) How does the digital learning resource support collaborative learning? c) To what degree can pupils and teachers add their own contents to the resource? d) To what degree does the teacher guide (if such exists) provide useful ideas?



## **Quality requirements**

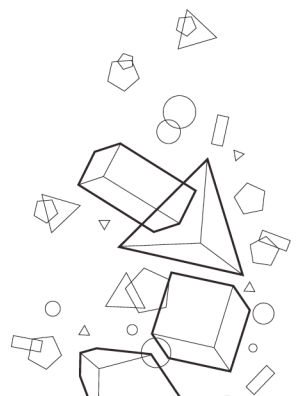
The educational resource is relevant for current curricula

The educational resource supports collaborative learning

The educational resource is well-suited to the target group

The educational resource has built-in evaluation capabilities

The educational resource can be supplemented with user content and contains a teacher guide





## Technical Aspects

### Introduction

As was the case with the educational criteria, we must also evaluate the relevance of the technical requirements and recommendations in regard to usage area and distinctiveness. When establishing specifications for purchasing, all the following requirements and recommendations must be evaluated in light of the resource that is to be purchased, as not all requirements and recommendations are relevant for all resources.

### Accessibility

Digital learning resources provide ample opportunity for adapting the learning needs of different pupils within a number of skill areas, whether written, visual, auditory, and so forth. Designing accessible digital learning resources is a question of enabling as many pupils as possible to use the resources, independent of their capabilities. Pupils and students in Norwegian schools have a statutory right to a learning environment that is adapted to their needs [1]. The use of ICT is an integral part of education, and the option to adapt digital resources to the individual's needs is therefore critical. A prerequisite for such adaptation is that the digital learning resources have been designed in accordance with the principles of universal design. Universal design is the design of products and environments in such a way that they, as much as possible, can be used by everyone without the need for adaptation or a special design.

**Requirement:** Digital learning resources shall be designed in accordance with the guidelines for accessible web content (WCAG) 2.0, at a minimum on level AA [2].

In addition the following guides are recommended:

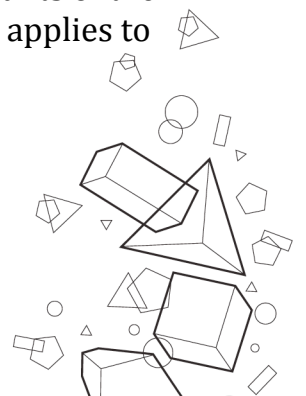
*The Development of Multifunctional Learning Resources for Pupils Who Use Alternative Keyboards and Mice to Use Digital Learning Resources (in Norwegian) [3]*

*How to Make the Internet Accessible for the Visually Impaired (in Norwegian) [4]*

*Cognitive Accessibility of Web Pages and Web Sites (in Norwegian) [5]*

### Parallel editions

The Norwegian Education Act and its attendant regulation state that learning resources must be available in both Bokmål and Nynorsk (the two variants of the Norwegian language) at the same time and at the same price. This also applies to digital learning resources.



**Requirement:** Digital learning resources shall as a rule be available in both Bokmål and Nynorsk at the same time and at the same price.

Section 9-4 [6], first paragraph, of the Education Act states that “in subjects other than Norwegian, textbooks and other teaching aids may only be used when they are simultaneously available in both Bokmål and Nynorsk at the same price”. This entails an individual right for the pupil to have his or her learning resources in either Bokmål or Nynorsk. This should furthermore be perceived as a requirement to the school owner (whether public or private), when the school owner is to decide which learning resources are to be used in the various subjects.

The contents of section 9-4, first paragraph, of the Education Act are elaborated in chapter 17 in the attendant regulation [7]; which specifies that the requirement does not pertain to the subject of Norwegian. The requirement pertains to digital learning resources that are used on a regular basis in education and that cover significant parts of the general goals in the curriculum or significant parts of the goals, subject matter, or primary elements/main topics in a subject in regard to the subject’s curriculum. The requirement only applies to cohorts that exceed 300 pupils.

It would also be beneficial if the digital learning resources facilitated the creation of different language versions, so that it would be easier to make versions for the Sami languages, sign language, and so forth.

### *Metadata tagging*

A digital learning resource should be described by means of metadata, that is, data about data. The purpose of tagging digital learning resources with metadata is to make it easier to retrieve, reuse, and manage the resources. A metadata specification indicates how the resources are to be described. Agreeing on a common specification for how to write metadata serves to facilitate a homogeneous description of resources and exchange of metadata between different systems.

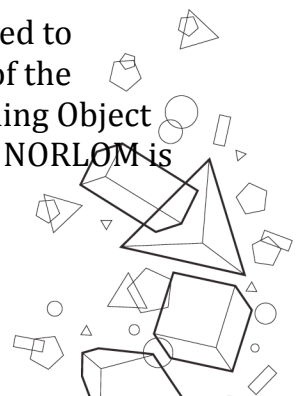
**Requirement:** Digital learning resources shall be tagged in accordance with NORLOM version 1.1.

**Recommendation:** Digital learning resources should be classified in accordance with curricula by means of the Grep database.

**Recommendation:** Digital learning resources should be tagged with the conditions that apply for using the resource.

## **NORLOM**

In the Norwegian education sector, the specification NORLOM [8] is used to describe digital learning resources. NORLOM is an application profile of the international LOM standard (IEEE 1484.12.1-2002, Standard for Learning Object Metadata), as adapted to Norwegian education. The current version of NORLOM is



version 1.1, published in October 2008; this version replaced NORLOM version 1.0, which was published in March 2005.

The following information about a resource is to be indicated in NORLOM v1.1:

- Identifier: a permanent and globally unique identifier for the resource.
- Title: the name of the resource.
- Language: the primary language used in the resource.
- Description: a text that describes the contents of the resource.
- Metadata identifier: a permanent and globally unique identifier for the metadata description (not the resource itself).
- Contributors: identification of the persons or institutions that contributed to the metadata description of the resource, as well as their roles in this endeavour.
- Metadata schema: name and version of the standard used to create metadata for the resource.
- Metadata language: the language used in the metadata description of the resource.
- Location: an address (typically a URL) to where the resource is located.
- Copyright and other limitations: conditions for the use of the resource.

The given tool used to register metadata should be able to generate several of the mandatory elements in NORLOM.

NORLOM 1.1 recommends that the following information about a resource should be stated: keywords, version, contributors, file format, file size, type of learning resource, projected user role, level of education, cost, and subject classification.

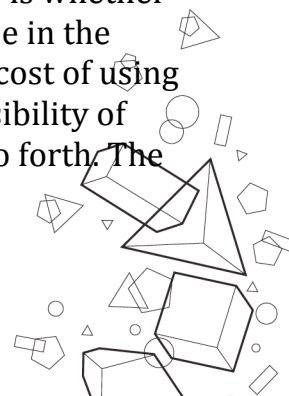
## **Grep**

Grep is a national database for subjects, curricula, and educational provisions within primary education. All the curricula from the Knowledge Promotion Reform are registered in Grep, in addition to administrative information concerning subjects in primary and secondary education. Grep is in other words not a metadata standard, but can be used to tag learning resources in accordance with subject or competence objectives in curricula for primary education. The purpose of tagging digital learning resources in accordance with Grep is make it easier to find resources that address specific elements in the curricula. The use of NORLOM 1.1 is recommended for indicating Grep codes. The guide to NORLOM 1.1 [10] describes how this type of information is to be indicated.

Information about how to use data from Grep in order to present the contents of the curricula can be found in GrepWiki [9].

## **Conditions of use**

An important consideration when procuring digital learning resources is whether the conditions of using the resource are in the line with the planned use in the education setting. In addition to information concerning the potential cost of using the resource, this might pertain to licensing terms concerning the possibility of modifying the resource, sharing the resource with other parties, and so forth. The



use of NORLOM 1.1 is recommended when stating the price and conditions of using digital learning resources. The guide to NORLOM 1.1 describes how this type of information should be indicated.

For further information and questions and answers concerning this topic, see DelRett [11], Norway Opening Universities' advisory service for using and sharing digital learning resources.

### *Technical interoperability*

The purpose of the technical quality criteria is to ensure that digital learning resources can be used regardless of operating system and web browser. The basis for selecting the given formats is that they are based on open standards, are widespread, and have good built-in support or can be used with plug-ins or software that are readily available for most operating systems and web browsers. Some of the proposed formats do not meet all these criteria, but are included nevertheless because they represent the optimal alternative for certain purposes.

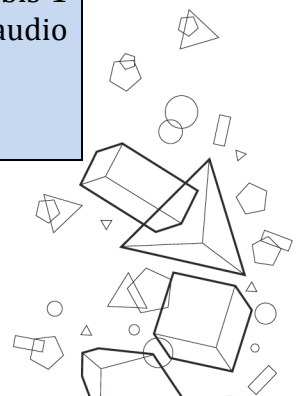
The requirements and recommendations in the technical quality criteria are based on the Norwegian Standards Council's reference catalogue for IT standards in the public sector, version 3.0 [12].

#### **Requirement:**

- Document format:
  - HTML 4.01 / XHTML 1.0 for digital learning resources designed as web pages
  - PDF 1.4–1.6, PDF 1.7, or PDF/A for finalized documents
  - ODF 1.1 for documents that are to be edited
  - UTF-8 for HTML and XHTML documents
- Authentication:
  - FEIDE

#### **Recommendation:**

- Images and graphics:
  - JPEG for lossy compression of images
  - PNG or GIF for lossless compression of images
  - SVG 1.1 for scalable graphics
- Audio and video:
  - MP3, AAC, or Vorbis 1 encapsulated in Ogg for lossy compression of audio
  - FLAC 1.2.1 for lossless compression of audio
  - The video track coded in Theora 1.0 and the audio track in Vorbis 1 encapsulated in Ogg, or the video track coded in H.264 and the audio track in AAC encapsulated in MP4 for video
- Rich Internet applications:
  - Flash, Silverlight/Moonlight, or Java Applets



- Adobe Air
- IMS Common Cartridge
- Stylesheet:
  - CSS
- Mathematical expressions:
  - MathML
- Assignments and tests
  - IMS Question and Test Interoperability
- Packaging:
  - IMS Content Packaging
- Communication:
  - IEEE 1484.11.2-2003 – ECMAScript Application Programming Interface for Content to Runtime Services Communication

### **Document format**

HTML [13]/XHTML [14] shall be used for structuring information, such as text and images, in digital learning resources designed as web pages. The character set standard ISO/IEC 10646 [15], represented by UTF-8 [16], shall be used for HTML/XHTML documents. When it is desirable, for instance to preserve formatting, that both finalized documents and documents that require further editing should be published in formats other than HTML/XHTML, the following format is to be used: PDF [17, 18, 19] for finalized documents and ODF [20] for documents that require further editing. For the time being, ODF has only a limited distribution. The temporary recommendation is therefore to publish in parallel in one or more additional formats to ensure that the documents are generally accessible.

HTML/XHTML documents are made accessible by following the guides and guidelines that are cited under the requirements and recommendations for accessibility. The Norwegian Agency for Public Management and eGovernment's guide [21] and quick guide [22] for the universal design of electronic documents are also recommended, so as to ensure that documents created in PDF, Microsoft Office, and OpenOffice are accessible.

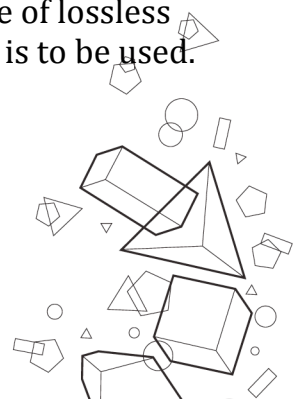
### **Authentication**

If the digital learning resource requires login, it must be able to authenticate users through the education sector's common login system, FEIDE [23].

### **Images and graphics**

JPEG [24], PNG [25], and GIF [26] are recommended for images. JPEG offers lossy compression, while PNG and GIF offer lossless compression. The choice of lossless or lossy compression depends on the contents of the image and how it is to be used.

SVG [27] is recommended for scalable vector graphics.



Images and graphics in digital learning resources that are designed as web pages are made accessible by following the guides and guidelines that are cited under the requirements and recommendations for accessibility. For use in documents in other formats, see the guides cited in the previous section on document standards. The guidelines from W3C [28] are recommended for scalable vector graphics.

### **Audio and video**

MP3 [29] and FLAC [30] are recommended for audio. MP3 offers lossy compression, while FLAC offers lossless compression. The choice of lossless or lossy compression depends on the audio quality that is required. MP3 has extensive tool support, while FLAC has more limited support. For lossy compression, Vorbis [31] encapsulated in Ogg [32] or AAC [33] can be used as an alternative to MP3.

The recommendation for video is the video track coded in Theora [34] and the audio track in Vorbis encapsulated in Ogg, or the video track coded in H.264 [35] and the audio track in AAC encapsulated in MP4 [36].

Note that there is limited tool support for Vorbis and Theora.

Audio and video are made accessible by following the guides and guidelines that are cited under the requirements and recommendations to accessibility that highlight subtitles, visual interpretation, sign language, and other options as alternatives to audio and video.

### **Rich Internet applications**

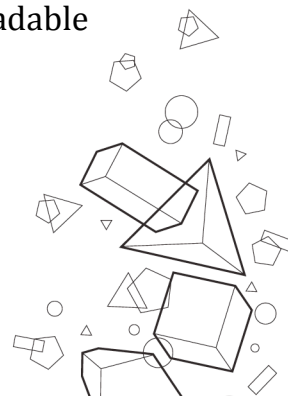
Rich Internet applications are software that is based on web standards. They have the same characteristics and functionality as traditional software, but can be run without installing the software. For applications that run directly in the web browsers, Flash [37], Silverlight [38]/Moonlight [39], and Java Applets [40] are recommended. Adobe Air [41] is recommended for applications that run externally to web browsers (desktop applications).

IMS Common Cartridge [42] defines an open format for the distribution of rich web-based content that is dedicated to learning in particular. It is recommended for content that is to be imported to learning platforms and similar systems.

Rich content and rich applications are made accessible by following the guidelines for accessible rich Internet applications (WAI-ARIA) [43] that focus in particular on dynamic content and advanced user interface controls.

### **Stylesheet**

Using CSS [44] as a stylesheet is recommended in order to separate structure and presentation in HTML and XHTML documents. The use of stylesheets enables the transformation of content so that it can be adapted to different purposes, such as using a screen reader. It is important that the content also retains a readable structure when CSS has been turned off.





## **Mathematical expressions**

MathML [45] is recommended for presenting mathematical expressions in HTML/XHTML documents. Among its other advantages, presenting mathematical expressions by using MathML instead of images will make the expressions accessible to screen readers.

## **Assignments and tests**

Many digital learning resources contain assignments and tests. Such assignments typically contain descriptive text or images, as well as the option for the user to complete the assignment through various mechanisms. In order to ensure the exchange of such content between different systems and facilitate reuse, a standard format for designing digital tests must be used.

IMS Question and Test Interoperability [46] is recommended for digital assignments and tests.

## **Packaging**

Digital learning resources are often a composite of various media forms, such as text, images, and video. So that a learning platform can import and play the learning resource, it is important that the education content is organized in a certain way and is preferably packaged in a single file.

IMS Content Packaging [47] is recommended for packaging digital learning resources.

## **Communication**

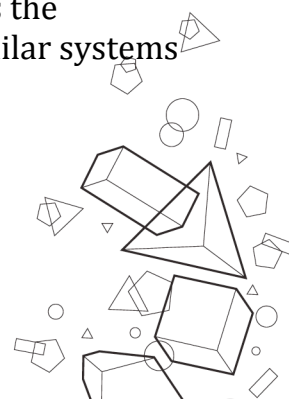
If the digital learning resource is to be used in a learning platform, the need will often arise for exchanging information between digital learning resources and the learning platform. Digital learning resources should then be designed in accordance with the standard ECMAScript Application Programming Interface for Content to Runtime Services Communication [48] (formerly AICC CMI001 Guidelines for Interoperability).

## **Standards under observation**

In addition to following the above requirements and recommendations, it may also be beneficial to know of upcoming standards that in all likelihood will be included as a requirement or recommendation in future versions of the quality criteria.

Metadata for Learning Resources [49] is a new international standard for tagging learning resources with metadata. The standard facilitates searching for, acquiring, evaluating, and using the resources.

The IMS Learning Tools Interoperability (LTI) [50] standard facilitates the integration of external tools and content in learning platforms and similar systems and the exchange of data between such systems.



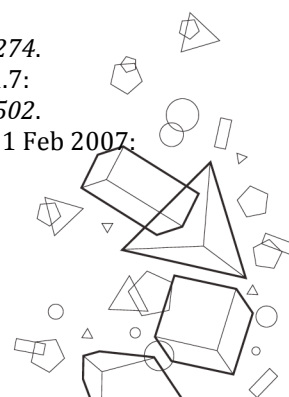
The IMS Interactive Whiteboard Format/Common File Format (IWB/CFF) [51] standard defines a file format for content that is to be shown on interactive boards and large display areas.

HTML5 [52] is under constant development and is gradually being implemented in the major web browsers. The new features in the standard include elements for multimedia and scalable vector graphics; these features make it easier to develop rich content that can be played directly in the web browsers without the need for plug-ins or other additions. The standard also makes it easier to develop apps and similar software that can be adapted and played regardless of unit or platform.

The EPUB 3.0 [53] standard is a format for distributing and exchanging digital publications and documents. EPUB is widely used as a format for e-books.

## References

1. Act relating to a prohibition against discrimination on the basis of disability (the Anti-Discrimination and Accessibility Act): <http://www.lovdata.no/all/tl-20080620-042-0.html>.
2. *Web Content Accessibility Guidelines (WCAG) 2.0*: <http://www.w3.org/TR/2008/PR-WCAG20-20081103>.
3. *Retningslinjer for utvikling av elektroniske læremidler* (Guidelines for developing electronic learning resources): [http://www.udir.no/upload/laremidler/Alternative\\_betjeningsmater\\_elektroniske\\_laremidler\\_08.pdf](http://www.udir.no/upload/laremidler/Alternative_betjeningsmater_elektroniske_laremidler_08.pdf).
4. *Internett for alle. Et hefte om hvordan gjøre Internett tilgjengelig for synshemmede* (Internet for everyone: A pamphlet on how to make the Internet accessible for the visually impaired): <https://www.blindeforbundet.no/internett/fakta-og-publikasjoner/brosjyrer/Internettforalle.pdf>.
5. *Utformingsveileder – Kognitiv tilgjengelighet av nettsider og nettsted* (Design guide: Cognitive accessibility of web pages and web sites): <http://iktforalle.no>.
6. The Education Act, section 9-4: <http://www.lovdata.no/all/tl-19980717-061-010.html#9-4>.
7. Education Act Regulation, chapter 17: <http://www.lovdata.no/for/sf/kd/xd-20060623-0724.html#map044>.
8. Norwegian LOM Profile for the Education Sector (NORLOM): <http://www.nssl.no/norlom/v1.1>.
9. GrepWiki: <http://grepwiki.udir.no>.
10. NORLOM 1.1 Guide: <http://www.nssl.no/norlom/v1.1>.
11. DelRett – veiledningstjeneste om opphavsrett og undervisning, Norgesuniversitetet (DelRett: Guidance service for copyright and education, Norway Opening Universities) <http://norgesuniversitetet.no/delrett>.
12. *Referansekatalog over IT-standarder i offentlig sektor, versjon 3.0* (Reference catalogue for IT standards in the public sector, version 3.0): <http://standard.difi.no/forvaltningsstandarder/referansekatalogen-html-versjon>.
13. HyperText Markup Language (HTML) 4.01: <http://www.w3.org/TR/REC-html40>.
14. Extensible HyperText Markup Language (XHTML) 1.0: <http://www.w3.org/TR/xhtml1>.
15. ISO/IEC 10646:2003. Information technology – Universal Multiple-Octet Coded Character Set (UCS): [http://www.iso.org/iso/iso\\_catalogue/catalogue\\_ics/catalogue\\_detail\\_ics.htm?csnumber=39921](http://www.iso.org/iso/iso_catalogue/catalogue_ics/catalogue_detail_ics.htm?csnumber=39921).
16. UTF-8, a transformation format of ISO 10646: <http://tools.ietf.org/html/rfc3629>.
17. ISO 19005-1:2005. Document management – Electronic document file format for long-term preservation – Part 1: Use of PDF 1.4 (PDF/A1): [http://www.iso.org/iso/iso\\_catalogue/catalogue\\_tc/catalogue\\_detail.htm?csnumber=38920](http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=38920).
18. ISO 24517-1:2008. Document management – Engineering document format using PDF – Part 1: Use of PDF 1.6 (PDF/E-1): [http://www.iso.org/iso/iso\\_catalogue/catalogue\\_tc/catalogue\\_detail.htm?csnumber=42274](http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=42274).
19. ISO 32000-1:2008. Document management – Portable document format – Part 1: PDF 1.7: [http://www.iso.org/iso/iso\\_catalogue/catalogue\\_tc/catalogue\\_detail.htm?csnumber=51502](http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=51502).
20. Open Document Format for Office Applications (OpenDocument) v1.1, OASIS Standard, 1 Feb 2007:





- <http://docs.oasis-open.org/office/v1.1/OS/OpenDocument-v1.1-html/OpenDocument-v1.1.html>.
21. Veileder – universell utforming av elektroniske dokumenter (Guide to the universal design of electronic documents): [http://standard.difi.no/filearchive/difi\\_veileder\\_uu\\_dok\\_v1.1\\_2.pdf](http://standard.difi.no/filearchive/difi_veileder_uu_dok_v1.1_2.pdf).
  22. Hurtigveileder – universell utforming av elektroniske dokumenter (Quick guide to the universal design of electronic documents): [http://standard.difi.no/filearchive/difi\\_hurtigveileder\\_uu\\_dok\\_v1\\_1.pdf](http://standard.difi.no/filearchive/difi_hurtigveileder_uu_dok_v1_1.pdf).
  23. Felles Elektronisk Identitet i utdanningssektoren (Common electronic identity in the education sector, FEIDE): <http://feide.no>.
  24. ISO/IEC 10918-1:1994 Information technology – Digital compression and coding of continuous-tone still images: Requirements and guidelines:  
[http://www.iso.org/iso/iso\\_catalogue/catalogue\\_tc/catalogue\\_detail.htm?csnumber=18902](http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=18902).
  25. Portable Network Graphics (PNG) Specification (Second Edition) Information technology – Computer graphics and image processing – Portable Network Graphics (PNG): Functional specification. ISO/IEC 15948:2003 (E): <http://www.w3.org/TR/2003/REC-PNG-20031110>.
  26. Graphics Interchange Format Version 89a, 1990: <http://www.w3.org/Graphics/GIF/spec-gif89a.txt>.
  27. Scalable Vector Graphics (SVG) 1.1 Specification: <http://www.w3.org/TR/SVG>.
  28. Accessibility Features of SVG: <http://www.w3.org/TR/SVG-access>.
  29. ISO/IEC 11172-3:1993 – Information technology – Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbit/s – Part 3: Audio:  
[http://www.iso.org/iso/iso\\_catalogue/catalogue\\_tc/catalogue\\_detail.htm?csnumber=22412](http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=22412).
  30. Free Lossless Audio Codec (FLAC): <http://flac.sourceforge.net>.
  31. Vorbis 1 specification: <http://xiph.org/vorbis>.
  32. The Ogg container format: <http://www.xiph.org/ogg>.
  33. ISO/IEC 13818-7:2006 – Information technology – Generic coding of moving pictures and associated audio information – Part 7: Advanced Audio Coding (AAC):  
[http://www.iso.org/iso/iso\\_catalogue/catalogue\\_tc/catalogue\\_detail.htm?csnumber=43345](http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=43345).
  34. Theora 1.0 Specification: <http://www.theora.org>.
  35. ISO/IEC 14496-10:2010 – Information technology – Coding of audio-visual objects – Part 10: Advanced Video Coding:  
[http://www.iso.org/iso/iso\\_catalogue/catalogue\\_ics/catalogue\\_detail\\_ics.htm?csnumber=52974](http://www.iso.org/iso/iso_catalogue/catalogue_ics/catalogue_detail_ics.htm?csnumber=52974).
  36. ISO/IEC 14496-12:2008 – Information technology – Coding of audio-visual objects – Part 12: ISO base media file format:  
[http://www.iso.org/iso/iso\\_catalogue/catalogue\\_ics/catalogue\\_detail\\_ics.htm?csnumber=51533](http://www.iso.org/iso/iso_catalogue/catalogue_ics/catalogue_detail_ics.htm?csnumber=51533).
  37. Adobe Flash Player: <http://www.adobe.com/products/flash/about>.
  38. Microsoft Silverlight: <http://silverlight.net>.
  39. Moonlight: <http://www.go-mono.com/moonlight>.
  40. Java: <http://www.java.com/en/download/index.jsp>.
  41. Adobe AIR: <http://www.adobe.com/products/air>.
  42. Common Cartridge (CC): <http://www.imsglobal.org/cc/index.html>.
  43. Accessible Rich Internet Applications: <http://www.w3.org/TR/wai-aria>.
  44. Cascading Style Sheets (CSS): <http://www.w3.org/Style/CSS>.
  45. MathML: <http://www.w3.org/Math>.
  46. Question and Test Interoperability (QTI): <http://www.imsglobal.org/question/index.html>.
  47. Content Packaging (CP): <http://www.imsglobal.org/content/packaging/index.html>.
  48. 1484.11.2 – 2003 – IEEE Standard for Learning Technology – ECMAScript application programming interface for content to runtime services communication:  
[http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?tp=&isnumber=28472&arnumber=1271478&punumber=8972](http://ieeexplore.ieee.org/xpls/abs_all.jsp?tp=&isnumber=28472&arnumber=1271478&punumber=8972).
  49. ISO/IEC 19788-1:2011 – Information technology – Learning, education and training – Metadata for learning resources – Part 1: Framework:  
[http://www.iso.org/iso/iso\\_catalogue/catalogue\\_tc/catalogue\\_detail.htm?csnumber=50772](http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=50772).
  50. Learning Tools Interoperability (LTI): <http://www.imsglobal.org/lti/index.html>.
  51. Interactive Whiteboard / Common File Format (IWB/CFF): <http://imsglobal.org/IWB/CFF/index.html>.
  52. HTML5: <http://www.w3.org/TR/html5>.
  53. EPUB 3.0: <http://idpf.org/epub/30>.

