Transnational exchanges of streaming material (including an exploration of forthcoming standards/standardisation)

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eStream

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By

Mathy Vanbuel and Mieke Bijnens, ATiT

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1. Foreword

Media play a decisive role for learning, both in the early years and in a lifelong learning perspective. The use of media to foster and facilitate learning in the school has been embraced by progressive pedagogical approaches, and it is increasingly becoming part of school curricula in many European countries. Teachers, in particular, can find in good media quality material, well adapted to students' needs, a most useful tool for teaching. Pupils' active role in the studying and learning process, clearly can be improved by successful use of media, they become more interested, attentive, focused, motivated, involved, excite and enthusiastic, even elated and fascinated.

There are however still a great number of challenges before learning with media becomes as natural as the use of more traditional classroom tools such as chalk and talk. Availability of good quality and affordable media materials, access to sufficient and appropriate technologies, training and support in the use and integration of media in the learning and teaching process are still considerable stumbling blocks on the road to more and better use of media in the classroom.

This publication is one of the outcomes of the eStream Project, a EU-funded project in the Socrates-Minerva framework aimed at promoting the exchange of experiences and sharing best practises on the use of streaming media in education in Europe, taking into account pedagogical, organisational, economical and technical aspects. The project aims to raise awareness and promote a better understanding of the educational potential of streaming media by disseminating best practises into European education systems at various levels. The project addresses educational and didactical aspects of the use of streaming media by actively involving the end users.

eStream has four specific objectives:

1. **To test and evaluate the value added to different teaching approaches and didactical strategies** when using streaming media in the classroom in different e-learning contexts, by collecting and analysing information on the present use of streaming media in classrooms in Europe and beyond; by evaluating within the schools participating in this project (all of which are actively involved in one way or the other in the application of streaming media) the pedagogical effectiveness and organisational impact; by undertaking research on the added value and on methods of incorporating streaming media into the learning process, evaluating the consequences and impact on the learning process and the mechanism of implementation; by testing the compatibility and, indeed, the possible synergies that may develop when interactive streaming is used in the context of a constructivist educational model.
2. **To develop support services for schools, by providing a series of working demonstrators** in the partner countries who can support the introduction and wider uptake of streaming media and adapt the technology to the particular needs and requirements of schools; by offering an online utilizing service to a wider community of schools, providing support in the form of a helpdesk, guidelines, case studies, training materials for teachers and other supporting information for the concrete implementation of streaming media in the classroom as well as in distance education; by developing strategies for the large scale deployment of streaming media in school networks.
3. **To network projects, experienced actors and institutions in Europe** in order to create synergies (competence-building and cost reduction by exchange

between research and development projects, and by increased up take), by organizing a small scale European seminar/ workshop by invitation for leading projects involved in activities similar to those of eStream; by supporting an online exchange of experiences and sharing of best practises; by organizing a single public European conference for projects and initiatives in the same thematic area (educational use of streaming media), on all levels from local to European level (the participants will not be funded from resources within this project); by establishing an online forum to discuss issues around sharing streaming material between the partner institutions (technical, financial, legal and educational aspects, standardisation, multilingualism, cultural and contextual adaptation); by jointly exploring forthcoming technical standards and solutions taking into account issues of standardisation and multilingualism and thereby further enhancing the European dimension, and representing the European educational community as much as possible in the fora where streaming media are discussed.

4. **To promote awareness and a better understanding of the potential for educational applications of streaming media**, by developing an online information and promotion service containing materials, examples (e.g. videos of actual use in classrooms, changes in the lesson preparation processes and as an integrated part of e-learning), tools and links; by disseminating the results of eStream (e.g. teaching methods) into the educational systems in Europe, especially to interested and/ or experienced teachers, teacher educators and trainers, decision makers and multimedia companies.

2. Executive summary

This publication on the current situation and (problematic) issues relates to the transnational exchange of streaming material, including forthcoming technical standards in the thematic area.

The eStream European Workshop in Leuven in May 2005, organised by ATiT, enabled a fruitful exchange between the partner institutions and other similar European projects on various issues: the technical, financial, legal and educational aspects, standardisation, multilingualism, cultural and contextual adaptation. The outcomes of these discussions that have formed the initial basis of this publication, contribute towards a framework or a mechanism for the transnational exchange of streaming material, that is taking into consideration the forthcoming technical standards and solutions accommodating exchange and multilingualism.

The moving image has been used for educational purposes for many decades now, starting from the magic lanterns over a century ago to the latest web streaming technologies. Traditional means such as broadcast television and videotapes however lack the interactivity needed for a meaningful learning experience.

Nowadays, digital online media can be used as an interactive and integrated tool. Online videos can be linked with slides, supporting texts, discussion boards, chat, resource links etc. as part of or even embedded in a virtual learning environment. Also the fact that creation of digital video is becoming technically so easy and affordable has changed the nature of the use of video.

Videos viewed either through television or computer can be seen as tools for learning, but we should always remind ourselves that they are just one component in the complexity of a teaching and learning system. In this publication the issue of media content and its use is always discussed essential as an integrated part of the overall learning environment. The main focus will be on the aspects of transnational exchange of streaming media in an educational environment, including the forthcoming technical standards in the thematic area.

We will treat educational technical, financial as well as legal aspects of streaming and the transnational exchange of it and we will try to find out what the possibilities are regarding the standardization of the process. Standardizing a large concept as streaming can't however be taken for granted. Linguistic, cultural and contextual elements play an important role in this process and will therefore be taken in consideration while looking for opportunities. The first part treats the current status of streaming media and examples of the transnational exchange of it and the second focuses on future perspectives and possibilities regarding standardization. The first chapter is subdivided into educational and technical aspects and will provide a large overview of the aspects that need to be taken in consideration when using streaming in a transnational as well as local context. The second chapter will try to tackle the main shortcomings in the field of streaming with a particular emphasis on the transnational exchange of it.

3. Introduction

3.1. Who is this publication for?

This publication is for all people that are involved in the decision-making around the use of (streaming) media in education, this includes:

- Teachers that are experimenting or putting into practise the use of media in their classroom and that want to know more about the state of play in the larger context,
- Headmasters and principles that are investigating what (streaming) media use can mean for education now and in the future and what decisions that may be expected from him in the future with regard to investment in support, training, technology or content,
- Researchers who are looking at how media use can be better integrated in the learning and teaching,
- Researchers and developers, software and service providers that are looking for domains where their solutions can have an impact on the teaching and learning practise,
- Decision makers in the national, regional or community schools networks, ministries or departments of education, looking for a digest on the status of this tool in an international context,
- Policy makers on all levels (from the national to the European level) that want to understand the issues that are hindering or favouring the use of media in education.

This publication addresses mainly the compulsory learning communities, but a number of aspects go well beyond the boundaries of that community: for example the technological developments are not specific to that area (and in fact go almost always completely way beyond the domain of education as they are universal developments), but also legal aspects such as IPR, linguistic and cultural issues are universal. We will however always try to indicate the relevance within the compulsory (primary and post primary) context.

3.2. What do we mean with streaming media?

Before we go any further, it is wise to clearly define the domain of our interest and specify what we mean by streaming media: Streaming media in our concept is the rapid transmission of audio and video in packets over the Internet.

Streaming media allows real time or on demand delivery of multimedia, using Internet based technologies. What happens is that media data are transmitted to the user while the media is being viewed. Video, voice, text or data are received in a continuous or almost continuous stream. Applications begin displaying these media as soon as enough data has been transferred from the streaming server to the receiving station's buffer. For a graphic representation of how streaming works see http://estream.schule.at/index.php?url=step1middle. Although that this definition excludes downloadable video, it is sometimes difficult to distinguish between both, certainly in the perception of the end users. Therefore we don 't make the distinction in this work, unless where it is relevant.

Streaming media is about access, and not as much about quality: pictures may be a bit blurry and the sound sometimes poor, but when a user clicks on a streaming link and gets media on demand, wherever he or she may be, the result can be really powerful. And fortunately, streaming technologies are rapidly improving, resulting in higher quality and even better access.

3.3. What do we mean with use of streaming media in education?

Images and sound, photographs, film and video, radio and TV have a long history in education. Back as for 1910, film was introduced in public schools in Rochester, New York. In 1934, the State University of Iowa began televised course broadcasts in subjects including oral hygiene and identifying star constellations. In 1976 a Japanese electronics company launched the VHS format, a tape format that allowed consumers to record video programmes.

Since film was first introduced in schools, nearly a century ago, a succession of moving image technology have rapidly been taken up by the educational sector: film, television, videotapes, videodisks, digital desktop video, multimedia, CD-ROM, interactive TV and now web-based media. The reason for this is that they add authenticity and reality to the learning context, bringing the course content alive. Since the late 1980s, with the introduction of videotapes, videodisks, digital desktop video, multimedia and CD-ROM, a new feature, interactivity has given moving images added educational value by providing easier and more controllable access for the user to the materials. With the advent of interactive video, the focus shifted from representation of images to control. Now the learner can control the pace and the content of whatever he or she is watching, choosing the parts of the video to be shown, pausing, rewinding and forwarding whenever necessary, independent of time and location. Before interactivity became possible, video could be used only as a presentation tool, focussing on the moving image itself. In a classroom context, everyone watched the same sequences, chosen bye the teacher, at the same moment in time which meant that students passively viewed whatever the teacher had decided they should see.

Thanks to the Internet, media delivery has been revolutionised by the growth of the web as an integrated educational medium together with the rapid uptake of web-based video streaming technologies.

The Internet has not only facilitated the distribution of content, but it has also added another interesting potential to the use of video in the classroom, namely "integration". Learners view videos together with other learning materials, such as slides, supporting texts, chat, discussion groups, references, quizzes, etc. that are related or linked to them. Streaming videos together with these other materials integrate into the "virtual learning environment". Or to put it differently, one has only to access one medium, the Internet, in order to view all the materials.

The integrative combination of digital video with other tools converts video as a passive presentational tool into a dynamic medium that complements and adds visual richness to static text and graphic content.

Moreover the low cost and the high availability, quality and usability of the tools needed to create and publish ones own media materials, now provide educators and learners with the possibility to enhance their own expression and creation of teaching and learning materials and to exchange these via open platforms and channels. The cost of good quality cameras, the availability of desktop based editing software that is

easy to use, the possibility to integrate self produced video in presentations or in websites, allow educators to appeal to the media literacy of today's students and learners, and to improve their learning experience.

3.4. Focus on the transnational exchange of streaming media

In this publication we aim to identify the stumbling blocks and opportunities related to the exchange of media across borders. The major issues identified are the availability of good quality and relevant content, and the access to this for teachers and learners, and in addition to that the legal and financial aspects. Part of the access problem is the possibility to describe, index, search, use and reuse media, in other words the important issue of standardisation of content description and the building of user-friendly repositories. On a different level, there are obviously the linguistic and cultural issues, maybe the most difficult but at the mean time the richest aspect of the European Community. Furthermore we will look briefly in the expected technological development, with a view on potential use in the educational context.

3.5. What you will find in this book, what not.

This book will provide the reader with theoretical frameworks, examples of real world projects and pilots, research and development outcomes, related to the wider community of education and the use of media. It will not provide the individual reader with a guide on how to use streaming media in the classroom. There are other publications that can assist the reader in that, for example the Streaming Media in the Classroom book also from eStream, or the ClickAndGoVideo Materials. We would also like to refer here to many national initiatives in the teacher training that assist teachers and educators in getting acquainted with media use in learning and teaching. In the list of additional resources the reader may find some interesting links as well.

4. The current status of streaming media use in education: examples of exchange of streaming media.

4.1. Pedagogy

4.1.1. Introduction

Pedagogy is the correct use of teaching strategies: the instructor's own philosophical beliefs of teaching are governed by the pupil's background knowledge and experiences, personal situations and environment as well as learning goals set by the student as well as the teacher.

The innovation that the latest generation of Streaming Media has brought to the field makes it possible to integrate a variety of media and various channels. This makes it possible to have knowledge spread over several sources, which translates into more resources being available (with a click) and in the possibility, for the teacher and the students, to have incredible aid at hand that ensures access to technical knowledge and information about films, philosophy, semiotics, etc…as vast as the World Wide Web.

However there are a lot of questions to do with pedagogy and the lack of common understanding that tends to exist within those actively engaged in the promotion of technology in education. Much of this is because not only are they working in a relatively new sector but also due to the variations in background of the technology enhanced learning community. The lack of a coherent body of knowledge on teachers training and 'new' media is generally lamented, and described as a constant re-invention of the wheel.

Measuring pedagogical value is generally agreed to be key however and the need to create a comprehensive evidence-based body of research in this field to be shared amongst this community important particularly when working in the general education sector where resources are scarce.

Differences in the idea of streaming as product vs. process emerge and different expectations are expressed depending on whether we speak about teachers using existing video material, students using existing video material, teachers making their own materials or students making their own material. Teachers should not be able to learn from students – generally not a popular idea amongst teachers, nor do teachers like to learn from other teachers despite rhetoric to the contrary.

The central question we need to ask is– why streaming, why are we focussing on one particular type of medium, given the changeable world in which we live, it is likely that streaming will be replaced with another topical medium in a very short time and we will again start with the discussion about its pedagogical value. While there is little discussion about traditional media like books, there seems to be constant discussion about the pedagogical value of streaming.

Streaming media is a logical step in the development from text based to richer multimedia based learning, closer to the face-to-face learning environment. Therefore

the value of this medium as an educational tool cannot be ignored. And we should focus on what needs to be done to make this really work in the learning environment. In order to support this process best, we start by re-introducing some of the thoughts and opinions that underpin the learning process.

4.1.1.1. What is meaningful learning?

There are many definitions of what learning is, but for the purpose of this publication, we take a constructivist approach. As defined by Duffy and Cunningham[1] learning is an active process of constructing rather than acquiring knowledge, secondly is the act of instruction a process of supporting that construction rather than communicating knowledge. In that context, there are six principles that are generally acknowledged as being necessary for a meaningful learning process. Learning should be active, constructive and individual, collaborative and conversational, contextual, guided and emotionally involving and motivating.

Active

Within the constructivist views on learning, it is widely agreed that students learn best if they take an active role in their own learning. Many educators and researchers have argued for giving pupils possibilities to produce videos themselves. Several benefits for the learning process have been identified, such as the pupils' enhanced motivation and engagement with the subject matter.

Constructive and individual

Constructive learning means that learners accommodate new ideas into their prior knowledge. This process of constructing knowledge is a process of creation of meaning, not of knowledge reception. The meaning-making process results from puzzlement, perturbation, expectation violations and curiosity of cognitive dissonance. In other words, it is a process of making sense of the world around us.[2]

[1] Duffy and Cunningham (1996, 171)

[2] Jonassen (1995, 60)

Collaborative and conversational

Working in learning and knowledge building communities makes it possible that pupils can exploit each other's skills and provide social support and modelling for other pupils.[3]

Contextual

Contextual learning is that which resorts to learning tasks that are either situated in meaningful real-world tasks or simulated through a case-based or problem-based learning environment. One of the roles of technology in meaningful learning should accordingly function as a mind-tool.[4]

Guided

The concept of guidance is the distance between the actual developmental level of a child as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers.[5]

Emotionally involving and motivating

A growing number of researchers, especially educational psychologists, have argued that emotion is intertwined with cognition, motivation and learning and should therefore be studied more systematically in classroom contexts.

In the following pages, we will discuss the pedagogical aspects of learning with a special emphasis on the use of streaming media as a useful learning process. It will become clear that the above-mentioned factors will repeatedly appear in our vision on education with streaming media.

4.1.1.2. Motivation

The idea of using streaming media in the classroom is often already a major factor to motivate students to participate actively during the courses. Out of experience we discovered that students are generally more enthusiastic about the use of new technologies, in particular streaming media than traditional teaching methods. This has for a great deal to do with the fact that they are in their daily life making use of these new devices already, and they have the feeling they will need the use of this materials in their own later professional life. They expect the school not to be an anachronistic environment, where what they consider everyday tools and technologies (mobile phones, computers with Internet access, handheld personal devices and even game stations) are not allowed to enter. A second reason is the fact that exactly these new technologies allow them to access content when and where they want and allow them for example to look at the material on their own tempo and that they have the possibility to look at it again if necessary, which opens up new possibilities for the learning and teaching.[6]

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[3] Jonassen (1995, 60)

[4] Jonassen (1995, 60)

[5] Vygotski (1998, 86)

[6] Davideon, 2002

4.1.1.3. Selection of material

To a great extend, the motivation of the students and the impact of the material on the students, has to do with the selection of the material. Showing videos that are strongly related to the living context of youngsters will have much more effect on students then video that treats issues without any relation to their personal life. Showing a video of a popular programme out of the youngster's childhood will affect the students more than a video on Chinese pottery for example.[7] You should always be aware of the reference frame of the students to make an appropriate selection of the material.

4.1.1.4. Activation of preliminary knowledge

It's a basic fact that the learning process goes faster the more it is related to knowledge that students already gained before. Therefore education should begin with the initial status of the student's knowledge. The responsibility therefore lies with the teacher, who has to make sure he knows very well what the student already knows and at what point he has to start giving new information. However "knowledge" can fade away slowly so it's a necessity to activate existing knowledge first before providing new information. Audio and video are strong media to do this, if of course the material is related to this knowledge and if it provokes strong emotions towards the subject matter.

4.1.1.5. Knowledge transmission

There are several ways to transmit knowledge to other people. Except for the traditional ones (student to student, teacher to student and books), the new evolving media recently came up as a new major source of information. However until now, the new media were often used more as a study object of their own instead of as a skill or knowledge tool. For example, until few years we saw that students learned about ICT rather than that they learnt how to use ICT in their learning and other activities.

The advantage of streaming media here is that it's a very flexible system of transmitting data. It's a user friendly system which can be forwarded, rewound, stopped and replayed whenever the users wish to do this, with the additional advantage that it is very easy to use and there is almost never any skill to be acquired to use video as it is a familiar instrument for this group of users (remember how teachers used to struggle with VCRs while youngsters had no problem programming and operating them at home as well as in school.)

4.1.1.6. Curriculum.

Although streaming is a fast and easy to use to for data transmission it is, like we said before, very important to select the right materials to show in class. The same rules as applied to traditional teaching methods, should therefore be applied for classes where streaming media are used. Teachers should prepare their lessons and make a lesson plan with a clear goal in mind, and not use the video as a "baby sitting" activity. They could make a table of content with the streaming materials they will use and explain why they are useful regarding to the topic of their course, how they use the video in context with other activities and materials.

[7] Davideon, 2002

4.2. New ways of learning with streaming media.

In the former paragraph we discussed some general pedagogical issues that should be taken in account when teaching. Whether it is streaming media, ordinary audio-visual material or textbooks that are being used, the pedagogical ideas behind teaching don't change very much.

But the possibility of using streaming media offers of course alternative ways for the traditional teacher-to-student teaching, especially because it's a very user friendly and it can be used as a personalised or individual way of learning.

4.2.1. Structure: creating a basis for self-learning

Streaming media is mostly used on individual basis, which has mostly to do with practical reasons. Streaming media are to be found on the Internet, which means that you should sit behind a PC to be able to look at it. Of course, there are various possibilities of connecting a computer screen to a projector, and a projection screen on the wall, but in this case it is probably even easier to use an ordinary video player, also because the quality of the streaming media nowadays limits viewing to rather short viewing distances, which are typical for P(ersonal) Computers. This individual use has several consequences from which the most important one is that it requires a whole new method of teaching. Instead of explaining something and showing audio or video material to a whole class, teachers need to approach the students in a different way. We suggest the following pattern:

Photograph courtesy of Art Ó Súilleabháin, MEC

4.2.1.1. Competent teachers

First of all, each teacher should try to develop the essential knowledge and skills pertaining to videos and communication in order to act as a cultural mediator within a social context increasingly characterized by the presence of media. In order to be able to transmit knowledge and skills in this field, it's an absolute necessity to understand the matter completely yourself. This requires of course a strong effort from the teachers

themselves. Professional training could be a good way to support teachers in their own learning process.

4.2.1.2. Knowledge transmission

As soon as teachers have the know-how, they can transmit their experiences to the students and create an environment where the students will learn step by step to use this tool on their own. An important task of the teacher is to humanize the technologies so the students approach medias in a methodical and mature way, and to propose them in the global view of information learning and not merely as instruments to use (from learning about the tool, via acquiring the necessary skills to adopt the tool effectively, to using the tool to acquire and construct new knowledge).

4.2.1.3. Competent students

As soon as students know how to use the tool, where to go for which information and how to work through this information, the self-learning process can start and each student can work on his own tempo to acquire knowledge. The student monitors and controls his own learning process. The teacher could support this by offering inter-term checks or evaluations.

4.2.1.4. Assessment

Of course, it is not enough having students look at streaming material without any form of evaluation or assessment. Here is the part where the teacher plays an important role again. From the start onwards, teachers need to be very clear of what they want to achieve with their teaching. The students have to keep this primary goal in mind during the whole learning process and at the end of the learning process; the student should be able to show that he reached the preset learning assets.

4.2.2. Content: thematic relevancy

4.2.2.1. Existing or own material?

It's up to the teacher whether he wishes to look for existing material or whether he wants to create his own material. Both have their advantages and disadvantages. When you create your own content, the material will be of maximum use for the goals you have set for the lesson in question. You create the content that you think is necessary and none of the content of your material will be useless with regarding to your course. On the other hand it requires a lot of effort and technical skills to do this. Producing sufficient quality learning videos that are effective in the classroom, is not an easy task, it requires multiple talents. Technical skills, as well as conceptual and narrative competencies, besides pedagogical competencies are all equally required. And although it is not impossible to acquired an acceptable level of competency in all the above, it often requires additional training of the future video teacher and then a lot of trial and error before the first useable videos are produced. After all not every teacher is born with Steven Spielberg's talent. This is very often considered unimportant in the minds of the teachers or in the minds of the pedagogical experts, but it should be kept in mind that the learners of today use what they see on TV, on the Internet and in movie theatres as the reference for media quality. Badly lit, shaky images with hardly

comprehensible audio, that are incoherently edited will distract them from the content message rather than support the learning process.

An interesting variation on this theme is the class-produced video (or videos produced by the learners themselves). When properly embedded in a sensibly constructed classroom activity, for example as a project based learning activity, this can combine the different elements of skill, competency and knowledge acquisition in a constructivist manner using tools and technologies that are relevant for and engaging today's learners. Again, this requires additional preparation from the teacher (or team of teachers), who will not only have to be skilled in the subject matter, but also in the media technologies and in the art of teaching media with and for media.

Using existing materials on the other hand, has the advantage that all the creative work is done, however you would still need to do a selection of the material that is related to your particular course. When you gather existing resources it is of importance to make a good selection of the available material.

4.2.2.2. Where to start looking for content

The first thing you need to know of course is where you should go looking for this content. Many of the content published on the Internet is not suitable for your students regarding the content and the level of difficulty. Furthermore, as we will discuss in a later chapter, not all content is in the language you prefer. Therefore it's important to find out what the main content providers are within your national borders or within your language group.

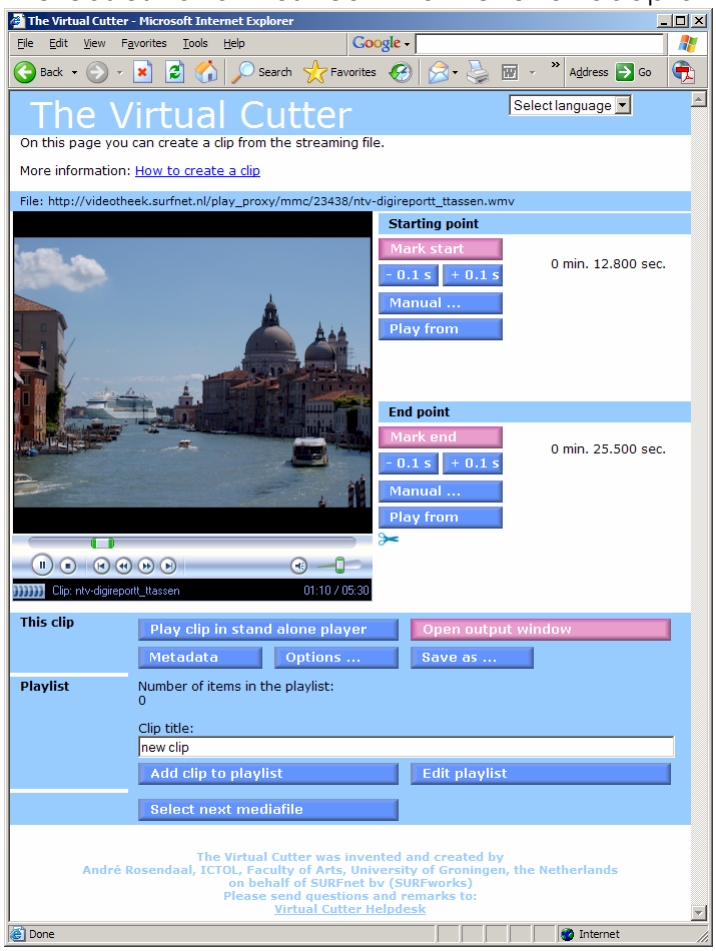
Assessment of content, criteria

Up until now, there are no universal or locally determined criteria for good and bad content. Streaming media is so widespread and decentralised that it is practically impossible to have a standardized tool for evaluating it. Even if everybody is convinced of the fact that this would be of great use, it could only be done on national level for content provided by official and recognized institutions like universities and educational institutes. The ministries of education for example could provide a corpus of existing materials, which can be incorporated into the official curriculum.

It is up to the teacher to decide which content he wants to use for his courses. A principle criterion that he should keep in mind is whether this content will add a value to his course and whether it will help the students achieving their learning outcomes. To make sure the content he's using is of good quality, he should use content from a content provider he's familiar with. On the other hand, there is no restriction for the teacher to be creative in is selection of content: a simple example will make this clear. While music video clips are not produced for educational purposes, it may be attractive to use for example the video clip of Eros Ramazzotti's "Adesso Tu" in the Italian language classes... In the history lessons, it may be useful to illustrate the textbook delivery with an excerpt from the BBC "Roma" series, etc.

Adaptation of content

When taking existing content, there is a chance that it doesn't completely accord to what the teacher intends to teach in his course. Therefore it could be useful if content can be adjusted to our own needs. Content may need different kinds of adaptation. The easiest and most common level of adaptation is shortening the video. To do this with streaming media, it is necessary to capture the streamed media and cut it yourself. This is not difficult but it requires some basic technical skills and at least a basic level of software and hardware.



Another possibility is to use the Virtual Cutter. With this tool you cut parts out of the streamed video or audio material and keep only what you find relevant. The Virtual Cutter[8] is a free and easy to use web-based application developed by André Rosendaal from the University of Groningen, made available by SURF, the Dutch higher education and research partnership organisation for network services and ICT. The tool allows users to create a selection of a streaming media file between any given starting point and end point. The most important benefit of the tool is that unlike conventional media editing tools (i.e. Final Cut Pro, Premiere, Pinnacle Studio) there is no actual capturing or file manipulation involved. A clip in the context of the Virtual Cutter consists only of a reference to a starting point and an end point of a streaming file; no new media file is created. This also means that users of the Virtual Cutter do not need to have access to a video server to distribute the clips they created: the link they create points to selected in- and out-points of the media file that remains untouched on the originating server, hence copyrights are not infringed, as no copies are made. An other advantage of the Virtual Cutter (in comparison to many other applications) is its ability to handle files from virtually every streaming server in the world. It supports a large number of different file formats and some of the most popular player applications, such as Windows Media Player, Real Player and QuickTime Player. Also the fact that everything happens within the browser window makes life for all end users very easy.

There are other ways in which the users may want to adapt the video: for example by assembling multiple parts, rearranging the order in which these parts are played, adding media from other sources (photographs, music, voice or other sound tracks, text displays, PowerPoint slides, etc.) This obviously quickly becomes increasingly complex and requires the type of skills and the equipment that is required to create ones own

[8] http://video.surfnet.nl/virtualcutter

resources from scratch. Again another desired adaptation might be the change of language: this is a form of editing that additionally requires linguistic skills. Just taking a text and replacing it by another language version of the same text almost always results in bad synchronisation of text and image, or other forms of decreased usability. Our lifelong experience of watching professionally made TV programmes, has set our level of quality expectations. During the long history of TV and media production (first public TV programmes were broadcast over 50 years ago) media professionals have learned what works and what does not work in terms of translation, dubbing and subtitling. The lessons learned there should be applied where possible. However, thanks to the universal availability of the technology (powerful hardware and easy to use software), everyone nowadays feels able to produce media that indeed may have a technical quality that was impossible to reach even in high end broadcast studios until not so long ago, but that are disobeying all the rules and laws of proper usable and narrative media creation. As we all agree that teaching should remain the responsibility of those people that are professionally trained and certified, we should also accept that the creation and adaptation of good quality media, other than media for restricted or personal use, is a profession in itself and that it should remain the job of responsible professional content creators and producers.

Note that in any case, media may be subject to IPR (Intellectual Property Rights) restrictions, that may disallow the user from downloading, capturing, adapting the media materials, and even from displaying the materials otherwise than on an individual display.

Finding the right mix

It is still not enough to only find the best matching content. Other elements play a major part in the effectiveness of the learning process of the students. Material that doesn't appeal in any way to the student's personal interests or atmosphere, will not keep the attention of the students, even if the content is perfectly suitable for the course it is related to. Young people nowadays are used to MTV style images, background noises, music and voice-overs at the same time. With the media materials it may be necessary to challenge their way of consuming media. While it may be attractive to say that a monologue of a person sitting on a chair may not keep their attention, we should remind ourselves that content comes before anything else. The learning and teaching requirements define first of all what content needs to be displayed. Only after the content has been selected, is it essential to decide on the right media in which this content will be displayed. The variety of media is very large and goes from oral (spoken word) via text (blackboard, notes, handouts, text and other books...) and images (still and moving, with or without sound) and eventually to multimedia or integrated media. It is crucial that educational content producers and teachers alike, carefully select the appropriate form and style for the content, and that they don 't get driven by the technology of the new media itself: the availability of new technologies should not be the driving force behind a certain media selection.

Multimedia or hypermedia Learning

In addition to the former paragraph, we need to refer to the possibility to combine several types of media in education and which is called "multimedia or hypermedia Learning". The streamed video is then part of a whole package of educational material, like for instance printed documents, websites, PowerPoint presentations etc. There are plenty of possibilities of integrating a simple video by means of other tools and methods, see for example the Media on Demand Service in Chapter 4.2.3.4 .

4.2.3. Content: structural relevancy

So far we have discussed the take up of streaming media content by the individual user. This can be considered as based on a free market model (the teacher is free to go, find and use streaming content, as long as it matches the teaching and learning requirements). In essence there are no issues that restrict the use of media independently from place and time, other than the general rules of Intellectual Property Right and possible specific rules that can be accompanying the media.

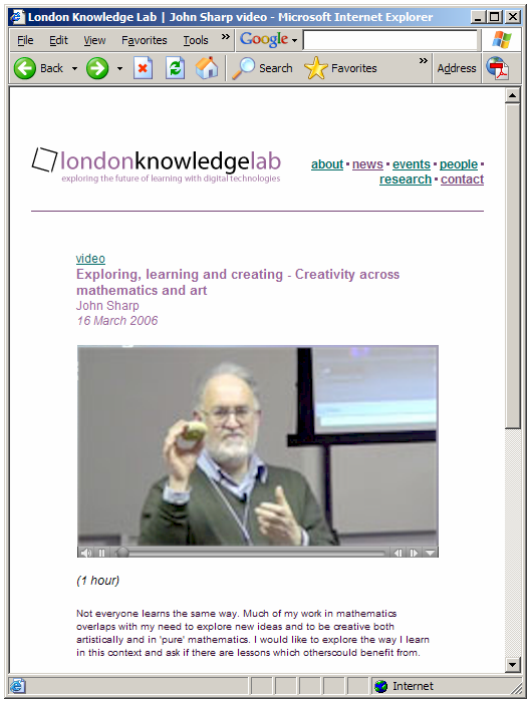
When looking at content that is created and/or made available to be used in a more intentional and structured way, we see a number of initiatives that are relevant, from individual institutions via content producers and broadcasters up to government agencies and even virtual organisations: in this part we will look at each of the different models and discuss briefly the issues relevant to exchange.

4.2.3.1. Education institutions: University and Higher Education vs. Secondary and Primary Schools

In higher education it is becoming common practise to provide certain lectures online through streaming, see for a number of good examples "Streaming Media in the Classroom". In secondary and primary education however we don't find examples of similar practise. This has several reasons.

The Lectures

First of all, lectures in Higher Education are more unique in their kind (as they are often elaborating a very narrow subject and even an original or individual approach to the subject), but at the same time they have a broader relevance, meaning a larger audience and less geographically determined. Their relevancy is equal for all European/international people involved in this topic of study: an example is the lecture on "Exploring, learning and creating - Creativity across mathematics and art" by John Sharp, recorded and streamed by the London Knowledge Lab (LKL) of the University of London. While it was initially a lecture aimed at students, post graduates and researchers at the LKL, it was also distributed via a streaming service on the LKL website to the wider research community and to the Kaleidoscope NoE in particular. It is obviously rather easy to make this type of content available as the lecturers are as domain specialists of great interest in their community, the content is furthermore not directly related or synchronised with any stage in the curriculum and therefore can be of interest to students at every level or moment in their study career and beyond. The content also does not need a lot of contextualisation (because the students are assumed to have a certain level of basic understanding of the matter as well as an individual interest and methodology in the processing and utilisation of the knowledge conveyed in the video. Last but not least, as the video is aiming at higher education, it uses English as the accepted common language.



A primary or secondary school teaching and learning activity on the contrary never has the same impact and relevancy across borders. Lectures are more fragmented and more dependent on the local context. Lectures are also much more interactive and physically involving the learners as an audience: while in higher education the ex cathedra style is still widely accepted – certainly where it concerns very specialised expert knowledge – this is not the common teaching style at compulsory education level. Furthermore there are a number of practical obstacles: school teachers are rarely good "TV presenters" and while this is equally the case with lecturers and professors in Higher Education, this fact is considered less an issue on that level because students easier make the distinction between form and content and therefore easier support less formal qualities (such as bad pronunciations, logical gaps, unelaborated examples and errands from the part of the lecturer) and technical shortcomings such as imperfect camera handling, sub level lighting, poor sound. While students tend to accept this in exchange for high level content, this is not the case with young learners, who will loose attention.

A distinction must be made with regard to the use of videoconferencing in education, where the above mentioned exceptions, are normally accepted in exchange for the live and interactive character of the media: the degraded video and sound quality, the spontaneous and informal way of communicating.

The lecturers – specialists

As mentioned before, the lecturers in higher education are to be considered as real specialists within their field of study. Their reputation is often acknowledged across borders. Furthermore, not each country or university has the possibility to attract specialists in every possible field of study, which means that they necessarily have to rely on specialists from other institutions or even other countries. The same is obviously not true for educators on compulsory level as these are normally not subject matter experts to the same narrow extent as higher education lecturers are. And because the content is more strictly linked to the national or regional education system, exchanges of classes is rarely appropriate across borders, while it may be valuable within the country of origin for example in the case of multigrade schools or in the case of interactive Radio or TV instruction.

The resources

Schools and institutions of higher education do not have equal opportunities when it comes down to creating this type of content: while in higher education there is often a technical or ICT department and in ideal cases even better, an audiovisual department to support the teaching and the learning, we see that on compulsory level, the creation of media content almost exclusively remains the task of an occasional enthusiastic teacher. Schools very rarely invest in the material and personal resources to set up a media creation centre. Furthermore for lecturers in higher education it is easier to afford the extra time and effort needed to create lectures that can be mediates, using good quality visuals, maybe even do a practical rehearsal etc.

Legal implications

Finally there are, as we mentioned before, the legal implications of the copyrights of the produced material. Lecturers in higher education in general create through their research, their own lecture materials, write their own books and syllabi, prepare their own courses, which implicates that they in most cases own the copyrights on their

lessons. It is their own decision, individually or in co-decision with their institution whether they allow the distribution of their learning materials for a broader public. Secondary school teachers on the other hand most of the time use books and other materials that are produced by external authors and published by commercial or other rights holding companies and institutions. This has a lot more implications regarding other distribution methods.

Conclusion

Video to conduct live or pseudo live instruction leaves local classroom teachers largely uninvolved in teaching, apart from preparing learners beforehand, ensuring attendance and attention, and discussing content afterwards. Videoconferencing, and Internet based response methods made it possible to improve the level of interaction between lecturer and the learner. Although that this model has been successfully adopted in higher education, in the classroom this type of programs rarely manages to hold learners' interest and therefore it is used only for very special occasions.

We conclude that at present, exchanging classroom based or teacher created learning materials across the border has a lot more relevancy and impact for the higher education level than for the secondary level. In general we could say that at the moment secondary education is completely or to a great extend organised through national systems while there is a trend towards the integration of universities on the higher education level.

4.2.3.2. The Role of the Broadcasters

A second form of streaming media uses existing television programs in classroom instruction. Teachers have always been creative and successful in using programs in the classroom that were produced originally for home viewing, and not necessarily for education purposes. In the past, teachers used to record programmes on videocassette recorders, which allowed them to choose what, when and how much to show. With the introduction of Internet connected PCs in the classroom and affordable video/data projectors, the use of the videotaped programme is on the way out, maybe for some time to come to live in concurrence with programmes recorded on DVD.

Meanwhile an increasing number of broadcasters are making their archives available to the public via the Internet, in that way targeting not just education but all users, often as a first step to the provision of (sometimes paid) access to all or a selection of programme materials. The Norwegian national broadcaster NRK for example uses its Nett TV portal or the Medieskolen project to make a selection of programmes publicly available. BBC also makes a number of its own programmes or parts of it publicly available independent of time and place via its broadband portal. Another good example is the Europe by Satellite Service from the European Commission. The

European Union's TV agency EbS was launched in 1995 and provides EU related media in up to 21 languages. The programming consists mainly of live events (EC press conferences and official EU events), but also stock shots and finished programmes on EU subjects produced by various EU Institutions and Directorates as well as other broadcasters. The access to the materials is free upon registration and use of the live or archived materials in education is unrestricted.

It is mainly – but not exclusively – the public broadcasters that are offering some of their programmes, besides regional or local TV stations, often in a way to respond to their public mission to provide information and education to the masses. The selection of programmes streamed is almost exclusively information based (news bulletins, information programmes and documentaries) and without very few exceptions produced entirely within the broadcaster's responsibility, in that way avoiding issues around IPR.

While it is normally quite easy to access these media, there still are some issues around their use in the classroom. It mostly requires additional research and effort from teachers to integrate these media in the classroom practise: to search them, to adapt them, to create the contextual information and learning and teaching materials. Obviously there may be language issues with some of the content. Because these programmes are not specifically made for education purposes, they also often fail to hold classroom attention for long periods of time or to engage the learners in a meaningful way. Furthermore, if teachers decide to show small portions of a series, they must find the appropriate segment among hours of materials[9]. Indexing and slicing (dividing the programmes in shorter blocks of media) are services that would be desirable to facilitate educational usage further. Until then, teachers have no easy way of identifying appropriate parts of media. Another important issue that remains is the IPR that may restrict certain uses of the media, certainly across borders when conditions of use are still different between different countries. The delivery network and technology still having its technical limitations, especially when retrieving content over the public Internet across borders, furthermore adds to the perceived quality of the materials. This may change favourably by the further deployment of higher bandwidths on all segments of the network: the feeder networks, the backbone networks, as well as the last mile. Another more important change may be the fact that while content may be for free for the time being, broadcasters are increasingly looking for revenue models for their regular content: TV programmes will become paid per view, be it over the Internet in streaming quality, or even more likely over the Interactive TV platform (iTV), which provides obviously the better viewing quality and conditions, but comes with a price for hardware (STB), subscription and licensing.

4.2.3.3. Media Designed for the Classroom.

Since the advent of affordable video technology for production and display (helped by the massive uptake of video recorders), more and more programmes have been produced by specialised producers specifically for use in the classroom. One of the initial drawbacks of educational linear video programme production by broadcasters and media publishers was a fixation on video duration of 30 to 60 minutes in analogy with the duration of the average television programme. Nowadays, videos are much shorter (on average not longer than 15 minutes) to enable teachers to use the video to

[9] Here too the Virtual Cutter would come to help.

establish a context for instruction and motivate student interest at the beginning of a lesson period while still allowing time to cover a curriculum topic by elaborating the subjects brought up in the video.

Educational media can be found in the catalogues of public and private broadcasters (many of them have built large archives of school TV programmes, for example the Dutch TELEAC NOT, the German NDR, Channel 4, BBC also in cooperation with the Open University, YLE) but also with commercial and/or educational publishers (Universal, Atlas, UFA, CTW, Hachette, IDTV, etc.) In Europe public service television broadcasters have always been highly motivated to help integrate the use of audiovisual resources in the education system and this tendency has increased with the arrival of the new technologies.

The educational media industry however – especially in Europe where the market is fragmented by national regulations, curricular distinctions, cultural differences and a multitude of languages – is not the most thriving business. School TV departments within public broadcasters have been dissolved in many countries or have been redirected towards edutainment. TV screens are increasingly being removed out of the classrooms and replaced by computers with an Internet connection. The traditional media producers are redefining their roles from linear video production towards creating multimedia, websites and interactive content.

In the case of the national broadcaster, they take the existing contents with them in this migration and re-purpose or adapt the content for a new way of accessing and using, taking advantage of the Internet. Teleac/NOT together with Kennisnet and Beeld en Geluid have started the disclosure of the archives of the Dutch public broadcasters on behalf of the education community, altogether over 9000 hours of audiovisual media by the end of 2007. All schools in the Netherlands will be provided with free access to these very rich online archives, at least until the end of 2007.

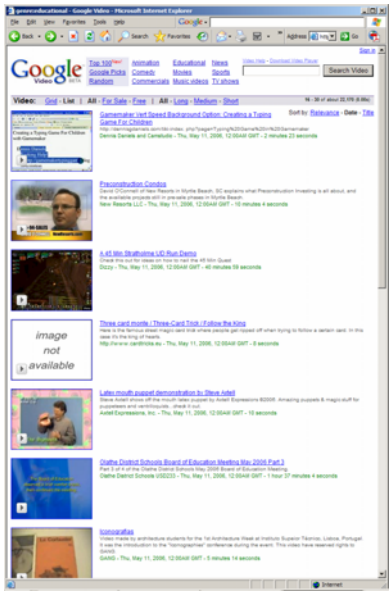
Meanwhile broadcasters in several countries are considering (or even working on) the deployment of a digital education channel.

This last as well the previous type of application, attempt to supplement classroom teaching and learning, rather than that they try to provide a video version of a traditional-style lesson. As an additional advantage over the previous instance, programmes created specifically for classroom use can focus on specific curriculum topics and can be accompanied with specifically prepared teaching and learning materials. This in turn may limit again the potential for deployment and uptake across borders, as there is normally little or no interest from the producers to invest in adapting, localising, translating media that may not have a career outside the own broadcast territory, without prior commitments from other broadcasters or without co-production agreements. As a result of this situation, exchanges of pedagogically valuable and high

quality media do not take place in a systematic manner: it is in fact hard for the educational community to know where to look for educational media outside of their own national or language borders. Initiatives in the past to encourage exchange on a pan-European programme and community level such as MediaNet Munich or the Rotterdam Market were unsustainable.

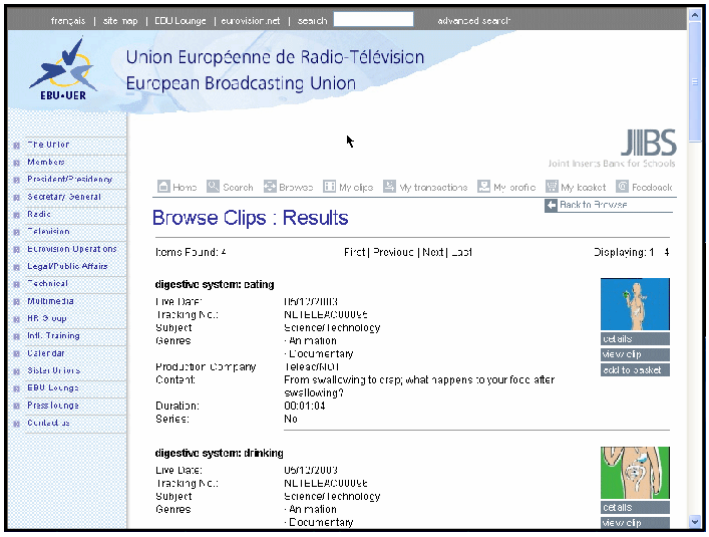
4.2.3.4. Content aggregation for classroom use

In analogy with music or other content specific community services, video portals seem to be the next big thing on the web. Commercial or public portals such as video.google.com are generating a lot of interest: for example in the google video portal or in YouTube at present there are already tens of thousands videos submitted to its subsection on education or science, left alone the videos that are contained in both complete sites. However the quality of the selection is unclear as there is no assessment other than on legal grounds (whether the video is incriminating laws on IPR, sex, violence, racism etc.) and teachers have no guidance or support in exploring or selecting videos that could potentially help them in the classroom practise as teaching or learning materials. The content is provided as is, with very limited classification and free text search that is not validated. Similar initiatives like Revver, Streamload and YouTube. Students and learners increasingly create their own media and publish it on the Internet, creating new web activities such as vlogging, vodcasting, videoblogging, often uncoordinated, sometimes in a more organised fashion, for example where the Flemish public broadcaster's youth service set up the 16plus service. While this service is a very strong and promising model for learning systems that are based on peer-to-peer exchanges or on communities of learning and self-activity, as a resource for present teachers they do not provide sufficient guidance and support. Note also that these services are for the time very much US oriented, but that they are increasingly gaining global interest and participating, be it that English remains the Lingua Franca of exchanges.

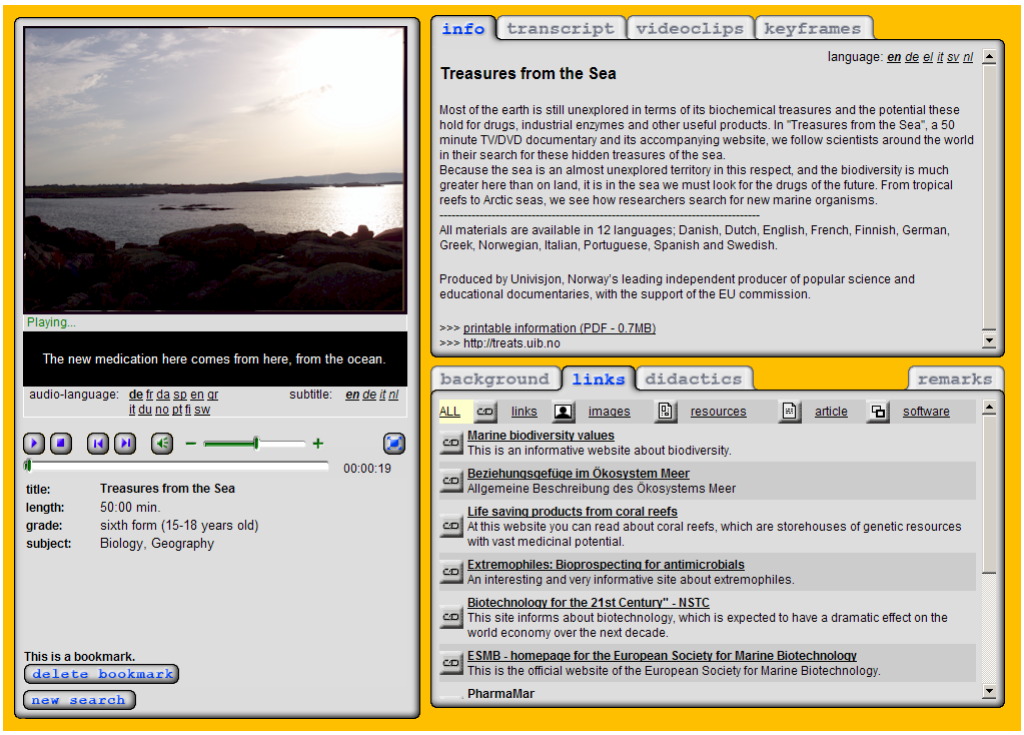


There are other initiatives that are much more relevant to the present reality and needs of classroom practise. One such example is the European Broadcasting Union project Joint Inserts Bank for Schools or JIBS. JIBS was launched by the EBU in 2002 by seven public service educational TV departments to explore the possibilities for the exchange of educational video clips from educational establishments in the participating countries. The work focused on defining quality criteria that the programmes should meet.

Work carried out in JIBS aimed at providing elements that can contribute to the definition of quality for educational programming. Educational programmes are intended to fit into a specific teaching context. The function that the teacher attributes to it in an education context is directly linked to the knowledge acquisition goals that the teacher has set himself. Its use will have greater relevance if other teaching resources support it: teaching sheets, accompanying booklet, videocassette, or the Internet. We can suppose that the relevance of use is closely connected to the richness of the teaching materials that accompany it that can take various forms that are present to a greater or lesser extent in the national platforms currently being developed.



JIBS was developed as a business to business platform, that allows easy online acquisition of short video clips (the maximum length of the media was set to 5 minutes) destined to the educational environment. The video clips that fill the JIBS bank are produced or chosen from the archives of the participating broadcasters following the highest quality standards (length, topic, target) agreed upon by the partners, then they are exchanged within the system database. JIBS aims at becoming a leading catalogue for short educational programmes, which will allow an international reach to a large variety of audiovisual material for the use of teachers and students. JIBS is not directly targeting the individual end user (the teacher or the learner) but rather the local broadcaster(s), providing them with a high quality satellite feed of the selected media on demand. How these media are further distributed down to school level is up to the local partner in JIBS.



The eStream Media on Demand Service

Another model for aggregation of content starts from the learning community rather than from the content providers: the Media on Demand Service developed by EDUCATION HIGHWAY in Austria. This service consists of a web client that provides access to a bank of media. Upon registration, the end user gets access to a portal like display where the user can select the media to be used and the language mode in which the video is to be displayed: language of the audio channel (if there are different voice over language channels available) or language of the subtitling (depending on the availability). The service allows registered users furthermore to provide a translation of the video (for subtitling) by means of the incorporated translated tool that makes use of a speech to text tool. The system furthermore provides didactical information, learning aims, background information, additional materials, links, transcripts of the video text, etc. all of which again can be translated and displayed in the desired languages. Its versatility makes the system suitable not only to many different linguistic or national territories but also to many different educational environments and methodologies. All this within a single online platform. A preview of this platform is accessible from a guest account (login: guest, password: guest) through the eSTREAM website (http://estream.schule.at/?url=mod). Here you will find for example the video "Treasures of the Sea" in multiple language versions and modes, as a good example of how exchanges can work.

5. Transnational exchanges: linguistic and transcultural developments.

During the discussions at the eStream Workshop in Leuven in May 2005, the participants discussed the issues that are hindering or supporting the exchange of media and streaming media in particular. The starting point was that even though that the Internet gives the impression of a global community and society, there are still many problems that are caused by the differences between countries and even sometimes between regions within the same country. The fact that there is until now still no commonly accepted and trusted market place for exchange of streaming educational media does not contribute either. A number of logical stakeholders such as EUN European SchoolNet and EBU were mentioned in that respect as potential stakeholders to effectively support the creation of exchange mechanisms.

Other points that were raised had to do with the legal problems related to exchange (such as Intellectual Property Rights) and the fact that in different countries. Technologically speaking there are no real issues except for the fact that iTV (Interactive TV) is rapidly becoming a reality in the media landscape. The position of the Internet and iTV besides each other in the provision of content may become an important new factor, causing concerns because of the different approaches they take on a technological level (TV vs. IP standard technology).

On the subject of standards, there are a numerous initiatives in the technological as well as in the content and educational domain. Certainly of importance to those who want to create, exchange and use media content outside of the own domain, metadata standards development is an important issue to follow. Questions rose whether it would be appropriate to consider the creation of a subset of for example the MPEG standards with an education extension (the Educational MPEG or EMPEG).

Other aspects had to do with the business or economic aspects of streaming media exchange: is it realistic to expect that content can travel free and that it can be used and adapted for every one according to their own needs? Is the market nig enough to support a sustainable industry, where mainly at the side of the production investments is heavy and where the demand is not necessarily demonstrated? Is this problem solved by the introduction of brokers, a concept that was strongly supported by the EC since the Fourth Framework and the Telematics Applications Programme? The balance between the commercial world of publishers and a non-commercial sector such as the education community remains an issue for all involved.

The obvious other aspects of the discussion leads to the use of language (and the opportunities provided by multilingual technologies such as subtitling/captioning). As here is an economical aspect: who should be doing the translation and adaptation? Logically speaking and in line with the IPR, it is the producer/publisher who manages and approves every process of content adaptation. But thanks to the digital technology where copies can be created without loss, it has become possible to allow end users (for example representatives of the education community) to create their own versions without too much quality losses. This is the same with cultural or person related aspects such as national educational standards, cultural background of education and media literacy. In the following parts of this chapter we go deeper into these aspects.

5.1. Language:

In the last 20 years, the Information and Communication Technology Revolution has helped information to travel freely and unhindered across country borders. Now that there are no longer prohibiting technical constraints, we are faced with the real content issues to do specifically with use of media in other geographical, cultural and linguistic user groups and school communities, for example the language and cultural context of the content.

A special consideration for video and spoken audio is that any narration may lead to difficulty not only for international users but also for users with a hearing disability. It is easier to understand written text in a foreign language because the reader has time to read and re-read the text at their own speed and any unknown words can be looked up in a dictionary. Spoken words are harder to understand, especially if the speaker is has a dialect, speaks too fast, or when the audio is poorly recorded and with a lot of background noise. A possible solution to these problems is to use subtitles but they special attention especially when used in streaming media on the web.

Multilingualism and multiculturalism should as much as possible be taken into account from the origination of the content. Governments in all European countries have created guidelines for teaching and supporting staff on how to deal with a multicultural population, and how to take into account the rights and requirements of minority groups. The existing guidelines on how to deal with respect for and fair treatment of other cultures, with inclusion, with gender issues, with disabled and minorities, with racism or xenophobia, are a good starting point also for creation of educational media. This approach will obviously not be sufficient to make all content suitable for use in all countries or with all groups of population, but it will prevent the largest misperceptions and conflicts. It is a misunderstanding that all content should be unified in order to be a-cultural or universal as this will wipe out the specific character of people in the various regions.

Multilingualism is not easy to achieve. For media productions that are from the conceptual phase onwards, targeted towards an international audience, it could be recommended to record various language versions from the onset. This is however a very expensive operation and therefore this is something that is almost never done, even in high-end productions for the international market. It certainly helps if one already during the production time takes into account possible future alternative language versions. Normally one does so by creating the so-called international version of the programme. In this version, synchronous sound in the language of origin, as well as the voice over and all other language sensitive sound is kept on separate sound tracks in order to be able to replace them at later stages when producing new language versions. An international image master will in turn contain no (or little as possible) captions so that during the post production new captions can be inserted. Very important is to keep all documentation (scenario, texts, voice over, transcripts, captions) well organised and together with the international master in order to be able to use this during the creation of consecutive versions.

It can be expected that there is an additional cost for this. As with all operations of this kind, the better the preparation, the lesser the cost for the highest possible quality eventually. Foreseeable costs for the original production team are the production of international master and the collection of the project documentation. This can amount to between 10 and 50% of the original postproduction costs, depending on the complexity of the postproduction.

When producing the new language version, additional costs will be for example transcribing (if not all texts are already available), translation, dubbing, voice over, subtitling (all depending on the type of versioning chosen), video post production, re-creation of shipping and accompanying materials, additional rights (e.g. for use of music in the new version and for the new territory). These costs can be substantial. High quality translation for example (which require professional competencies in order to do this according to the governing standards of quality) costs easily 15 to 20 Euros per minute of running text. Subtitling costs are depending on the use of professional personnel if it is to be carried out on the master, it can be avoided if it is done on a virtual copy (for example see the Media on Demand service from EDUCATION HIGHWAY). Dubbing is even more costly as it requires skilled actors. The choice between dubbing and subtitling is often a cultural one: while in countries like Belgium and the Netherlands subtitling is the common rule, in many other countries dubbing is common practise. Guidelines are different for both practises: for dubbing, timing and lip synchronisation are taken into account, subtitling on the other hand has the restriction of readability and the fact that the viewer cannot make the distinction between the different voices and characters from reading only. Subtitles need to be visible during a certain amount of time and the colour needs to be sufficiently contrasting with the background. The height of the font in TV lines or pixels and the position on the screen (when superimposed over the original image) are fixed in video production guidelines.

Using video based subtitling may be the solution chosen by the video producer, but better results can be achieved by putting the subtitles outside the video image itself, for example in an additional black area under the image. This does not increase the file size too much because the black area compresses well. Furthermore, this allows for the subtitles to be transmitted in ASCII or Unicode format and to be rendered on the streaming client PC, even with user selected language.

5.2. Translation options: services and tools

Although that there has been made great progress in automatic or machine based translation, based on Artificial Intelligence, quality translation is still for the largest part a human effort, despite the promises of the language technology industries of reliable translators becoming available within the years to come. Progress is being made thanks to increased computational power that became less expensive.

Today there are many software programs for translating natural language, several of them online. The most famous is the SYSTRAN system on which technology both Google's and AltaVista Babelfish's online translation services are based. Although that care should be taken using automated translation, these systems, like some others that are less widely known, provide reasonable output. Manual checking remains a necessity in any case.

Despite the inherent limitations of the technology, automated translation is currently used by many organisations around the world, amongst which the European Commission is probably the most important user. The EC uses SYSTRAN to handle the automatic translation of documents for internal use.

The evolution of machine and automated translation continues: Google is now developing its own statistic machine translation engine and also Microsoft's Natural Language Research group is developing its own system, currently testing various language combinations such as English-Spanish, English-Japanese, English-French and English-German. The technology uses both learned and manually developed language generation. To teach such translation systems large translation memory databases containing hundreds of thousands of sentences are used.

For the purpose of multilingual streaming media automatic translation can be useful in the process of adaptation. Integration in a fully automated workflow for adaptation however is at the present status of the technology and given the human input in pre- and post processing needed to assure quality, unrealistic. Therefore we prefer to use the computer-assisted translation in this context, whereby the computer program supports the translator, who translates the text himself, making all the essential decisions involved. In machine translation the computer or program translates the text, which can then be further processed or corrected by a human being. Probably the best-known system for computer-assisted translation is Déjà Vu.

Advantages of computer assisted translation are the high reliability, disadvantages are the time and cost of the human effort compared to the cost of the machine translation. In machine translation there are a number of open-source machine

translation software, mostly not integrated but some of them with good dictionary software/data and reasonable translation memories, examples are Apertium (Spanish), Linguaphile (dictionary look up for word-to-word translation), Logos Open Source Machine Translation etc. SYSTRAN is the leading provider of commercial machine translation software. Others are Language Weaver, IBM, PROMT and SDL Instant Translation Software Cost of systems vary from free for open source systems to almost 1000 Euros for the professional versions of Déjà Vu or Systran.

Translation is not necessarily a do it yourself job, professional services can provide high quality translations be it normally at high cost (between 1.25 Euros and 4.50 Euros per line of text depending on the language pair is a normal rate).

5.3. Localisation and cultural issues

Preparing content for use in an international context, consist not only of language adaptation of the core content as such. There are many other issues that we will not elaborate on but just indicate to demonstrate the potential complexity. Bear in mind that also the supporting and contextual materials (for example manuals, integrative websites etc.) may need adaptation as well. Similarly it is recommended to use a universally accepted date/time format for example UTC, and to take into account use of different calendars at least in international environments.

In some cases there is need to adapt the alphabets/scripts and the systems of numerals (for example left-to-right vs. right-to-left scripts). The use of Unicode for text encoding is the first necessary step to solve many of the problems related to content conversion.

Images of the video containing text and graphical representations of text on printed materials may need to be converted or recreated, just like the spoken word on the sound track. We already mentioned sub-titles in the previous part.

Then there are cultural issues such as the use of particular names and titles, or currencies (can we assume that the Euro is commonly known throughout the world?). Care has to be taken with selection of images and colours for issues of comprehensibility and cultural appropriateness (think of red, white ad black as being the colours of death in different parts of the world).

Certain civil issues such as social security numbers or the use of passports differ from country to country, and furthermore formats and representations of telephone numbers, addresses and international postal codes, weights and measures, paper sizes, etc.

Localisation specifically is about the addition or adaptation of content features in a specific locale. These features obviously include again language translation, but also the display and representation of local customs, local content, particular symbols, cultural values and social context. Also aesthetics make part of the local and cultural context.

On the one hand, technical guidelines, standards and tools are commonly available to support the internationalisation and localisation of the technological context (there are for example the W3C and the IETF standards). There is even the Localisation Industry Standards Association (LISA) that provides support, guidelines and best practices in this area. The study of these guidelines and standards is a starting point when considering preparing or adapting content.

It is clear that because cultural, personal and societal factors are such complex matters, the biggest problem is to assess which part of the content itself is culturally

transferable and which should be localised. In the commercial (education) media industry localisation is carried out by highly specialised companies. Directives other than the guidelines used in formal education related to the behaviour and attitude of teaching and supporting staff do not exist in a formal way. It could be considered that there is a role for example the EU, the Council of Europe or the Human Rights Commission of the UN to take up its responsibility in this and to create universal guidelines on the representation of content.

5.4. Financial and legal issues

Most important financial issues when sharing, reusing, buying, contributing to media (be it streaming or traditional, educational or others) and the commercial exploitation opportunities have to do with the possibility to become sustainable in this service. With the advent of the Internet and technologies that allow for (illegal) sharing and reusing and modifying of contents, such as Bittorent, Napster, Kaaza etc. the perception of the economical model in the view of the end users has somewhat degraded. Therefore it is good to emphasise the status of the IPR in general and to apply it to our particular subject.

5.4.1. Intellectual Property Right: the current status

Since the establishment of IP law in the 18th century, the economic purpose of IPR has been to encourage inventive and innovative efforts). Since the 1980s, the transition towards a knowledge-based economy, with an increasing importance of information, knowledge and innovation, makes IP issues become increasingly important and complex. This raises the question whether the existing IPR regime still sufficiently meets the new demands and conditions of the information society.[10] Despite the growth of digital media distribution over the Internet, copyright law has in some respects lagged behind and many believe that adaptations are required in order to give the new information and media systems and services a level of certainty in order to be able to evolve in creative ways to reliably and sustainable deliver content to consumers.

As with the invention of the video recorder and many other new media technologies, copyright law has lagged behind also with the adoption of the Internet as the new mass medium for delivery of all types of content. For example, the RAM memory buffer temporarily stores the streaming media file in the player while delivering the media to the user. This storage is technically necessary to guarantee the continuous viewing experience, but should it be considered because of rigid IPR definitions as a "copy" of the copyrighted work?

The generic principle of IPR naturally extends to works specifically created for education: for example schoolbooks, educational software and media. It also applies to works that are used in education but were not specifically created for use in schools, for example the works of a contemporary writer can be used but are protected by the law. Original teaching and learning materials that are created by teachers, school personnel and even learners themselves for use during education are also intellectual property and they are in principle owned by their creator(s). By consequence

[10] Universal Optimality versus Local Optimality in the IPR-debate, Victor Gilsing and Marianne van der Steen. Paper prepared for the EAEPE Conference "The Information Society – Understanding Its Institutions Interdisciplinary" Maastricht ,November 7-10 2003

theoretically they are protected from the moment onwards that they are put in one or the other tangible form: the creator (author) has the exclusive right of authorship: this means that no one else can claim the ownership over this creation, even when the identity of the creator is not explicitly mentioned. Schools however in principle inherit the related rights over these works (the rights to copy, alter, multiply, distribute) in order to make best possible use of these materials. This arrangement is often (and preferably) explicitly mentioned in the contract between institution and individual and allows for example the school to display and publish works that students have created or to re-use teaching and learning materials from teachers that have left the school. In general this means that teaching and learning materials (including video) that are created during and for school use, with resources provided by the school, can be used by the school without explicit permission from the individual creator(s), unless otherwise agreed.

Because IPR and the related rights are applicable to all original works, it is not permitted for the creator to use materials that are created by other people, without their permission, unless the creator is more than 70 years dead (50 in some countries). Practically speaking this means that for example, when a teacher is recording a video with his class, and he wants to add music to the soundtrack, he can use music from Mozart (because Mozart is long dead). This means that for example a gifted student can perform a piece for piano from Mozart from sheet music that he legally acquired (bought). He does not need permission from anyone. It is a different case when the same pianist wants to play and record a piece of U2, such is not allowed without explicit permission from the authors (U2). Note also that it does not mean that the teacher can take a CD with a recording of Mozart's music by the Berliner Filharmoniker and put that as a soundtrack under the video, because in that case the copyright (the right of the editors and performers on the recording of a particular piece) come into play. In that case it is no longer Mozart or his heirs that will claim the rights of use, but the performers of the piece and the publishers of the reproduction.

These are the basic rules. Fortunately the reality in schools is somewhat less strict on the use of materials created by others: it would be almost impossible for teachers to use (commercial) materials if they strictly went by these rules. Teachers (and learners or other school members that are creating teaching and learning materials) are allowed to use for example a recording of a TV programme in the classroom, without prior permission from the creators and the broadcaster, if the programme shown is relevant to the teaching and learning, only if relevant parts of the programme are shown and on condition that there is only educational and no commercial use or re-use. Again an example: the history teacher could show a small part of the movie Gladiator in his history lessons about Ancient Rome, but the school is not allowed to screen the whole movie to entertain the learners or even to keep the video copy in the school library. In fact, in some countries legislation restricts the use even further, for example in some countries showing a television program to your class that you recorded at home is allowed, providing that you show the program within a limited number of class-days after the date of recording.

It is allowed for more or less the same reason to use the lyrics of a Bob Dylan song during the English lessons for teaching and learning purposes, but it is not allowed to play commercial music in the student restaurant without paying royalties.

This regulation is called fair use. Making small excerpts of audiovisual works for classroom use can be considered fair use. The excerpts can be used in the classroom, but they cannot, however, be added to the school's library collection! The library will

have to purchase them for their collection if the excerpt is useful in multiple ways. Quoting from a work is allowed under similar conditions.

"Fair use" was working reasonably well in practice with respect to print materials until copy machines became more sophisticated and less expensive to use and, especially, until copyrighted material was being distributed in digital formats. People who are now developing educational multimedia material are discovering how powerful and confusing the application of copyright law and the "fair use" provisions can be in new media. Therefore a word of warning: the boundaries between quotation or fair use and ordinary use to which IPR and related rights apply, is vague and care should be taken to not challenge these boundaries as the consequences can be quite costly for the school. An example from the recent past: a school had used the rocket of Tintin [see http://en.wikipedia.org/wiki/The_Adventures_of_Tintin_(TV_series)] as an image in some of its internal digital learning materials. When the school wanted to demonstrate these learning materials on a teachers' conference, they were asked to remove the image of the rocket to avoid being sued (and probably being convicted to rather large penalties).

The same basic principle applies to all video materials created for streaming on a private internal school server. As long as the use of the materials is fair and meets the educational requirements for showing, there should not be any problem. When the school server is not a private (intranet) server but when the materials can be accessed from clients outside of the school boundaries, then care must be taken that there are no other materials, contents and components of the content that are not subject to IPR or related rights, unless explicit permissions are granted. Making content available beyond the school boundaries is a complex matter: what to do with access to the school server from the learners' homes, or even from any other place or even abroad where the learner may find himself?

Note also that rights are restricted in time (for example the right to use an image for x number of years) and in place (for use only within one particular country or Europe or worldwide…). Note also that due to the fact that the Internet and the World Wide Web are hardly contained by country borders, it is now common practise to obtain rights for "use on the Internet". Obtaining rights for use and reproduction can be not only very complicated and time consuming (to find out where the rights are handled and to negotiate usage) but also very expensive, although that in many cases special education rates apply. Still, it is wise to get information on the rights information before effectively selecting and deciding to use a copyrighted object.

In the previous part we explained how teachers could use materials that were created by others. The right to quote (to use a part or a representation of a certain work) is more or less regulated by what is called Fair Use Policy: for example, a teacher can use a photograph of the Mona Lisa in the classroom when he talks about this painting. He cannot use the same picture however in a handbook that he wants to publish or distribute without the explicit permission of the rights holders of that photograph. The teacher could try to be smart, travel to the Louvre in Paris, and take his camera to take a photograph of the original painting himself. A correct assumption because Leonardo da Vinci is dead longer than 70 years ago, so no permission needed… except of course from the Louvre itself!

The same is true for example, for a piece of music from the Beatles, it can be used in the classroom to illustrate a music lesson, but playing the same song during the school festival is not allowed without dealing with the rights.

It is important to note that the same rules which apply to all copyright works (e.g. books, graphics, software, CD-ROMs, videos, music records and films) apply to works found on the Internet. Works put on the Internet are considered "published" and therefore qualify for copyright protection. A work put on the Internet is not considered public domain simply because it was posted on the Internet and free for anyone to download and copy. You need permission from the site owner or the object creator to publish any materials, including photographs, music, and artwork from the site.

In the digital world, it is becoming increasingly difficult to control what others do with one's own work. Copying text, taking bits of movies, photographs etc. have never been easier. In order to fight this "abuse" of original works, various technologies are in development such as encryption, copy prevention, or Digital Rights Management (DRM), making use of for example electronic watermarks. In the (streaming) media world, using genuine streaming technologies where no copy of the media is left on the local client, or similar technologies such as Flash, allow for securing the content.

National or regional initiatives can play an important role in acting upon an appropriate implementation of IPR in educational (streaming) media initiatives. Initiatives such as Creative Commons, the Commonwealth of Learning, but also increasingly national broadcasters (such as the BBC, Teleac and NRK) or national and regional education initiatives such as EDUCATION HIGHWAY in Austria, D-scola in Italy, Canal Edu 365 in Catalunya, Landesfilmdienste in Germany, Mosaico in Italy are opening up their archives in order to give access to valuable media.

Meanwhile in the classrooms as well as in the heads of many educational content producers and providers, confusion and lack of understanding about IPR issues still prevail. Therefore, the first and foremost important task should be to provide relevant and helpful information about IPR and legislative aspects to all parties and individuals that are involved with the use and creation of media and content. There are still many misunderstandings about the true nature and aspects of IPR on all levels of the education community.

A resource centre that collects and discloses the relevant and up to date information would be to a great advantage to the whole education community. National agencies or specialised services within the relevant departments of education for example would come to great help here. The European Commission has already acknowledged this issue and supports the IPR Helpdesk (http://www.ipr-helpdesk.org/index.html), as a single point of access for information about all IPR issues, be it that it is not specifically directed at educational matters.

In addition to its first role as provider of reference information, such institution should become a pivotal point of support and information for the education community: by providing for example a helpdesk or even a legal support and information service that can assist individuals and institutions with specific questions, even in IPR related conflicts. Many important roles and functions can be assigned to such service:

- Identification and assistance in identification of rights, rights holders and rights free materials
- Assistance in clearance of rights
- Sharing and dissemination of information on IPR in general and IPR in education
- Training of users in correct management of IPR

- Provide legal support (and protection) to individuals and to schools in case of dispute
- Have a common voice for the education community in the debate about IPR (lobbying) and assist in policy making
- Negotiate blanket license for the education sector (for example country wide access to video materials that is archived at the national broadcasters)
- Set up services to enable easy access and exchange of media materials (for example the Video on Demand Service by EDUCATION HIGHWAY in Austria) in a protected or safely regulated user environment

Another recommendation to the governing and supporting organisations on national or even supranational level could be to include the basic understanding of IPR in the training programme of all education professionals that are in contact with educational content: teachers, content creators, administrators…

EC copyright legislation in general was far from homogenous but recent actions are trying to improve this situation. Most of it was enacted to address specific cases. Recent developments in the technology and the subsequent changes in use of media determine the further development of copyright law in the EC and what shape it will take in the future. Digital copying without quality loss, peer-to-peer technologies such as Napster, Bittorent, Gnutella or FreeNet, cacheing, multicasting and edgecasting are just some examples of how applications and use run ahead of legislation, putting users into what seems a legal void.

Moreover, the multiplicity of legal sources applicable to copyright protection in the audiovisual industry reflects in part the digitalisation of the media. Digitalisation creates new types of work (e.g. databases), new types of use for existing works (secondary exploitation in digital form) and new means of controlling use (through encryption or digital rights management, for example). This same evolution at the same time makes restrictions harder to enforce (digital copies being less costly, virtualisation of content location, cacheing, diverse casting technologies…).

Until now, there are differences between different countries, but these differences do not take away from the basic core of the IPR as described above.

All these elements plus the intrinsic virtual and borderless nature of the Internet and the World Wide Web in particular, surpass the present legal situation. To respond to these challenges, on 29th of April 2004 the European Council and Parliament have accepted the EC Directive 2004/48/EG concerning the application of IPR in all EU member states, to harmonise the legislation in this domain.

But for the average media user and producer, it is still very difficult to understand and accept the limitations that IPR imposes on these media as representations of knowledge, and that should be free to travel and be used.

In order to make it easy for a creator to manage his/her own rights while still complying to the basic rights of ownership and exploitation, an IPR protection scheme such as Creative Commons (see www.creativecommons.org) could be of great help: this scheme provides the content creator (no matter what type of content: text, media, sound… commercial, non-commercial etc.) with clear and intelligible formulations of various types of rights claims. Simply speaking, Creative Commons helps the creator to publish his/her work while letting others know exactly what they can and cannot do with that work. Creative Commons, has taken a bottom up approach to the problem:

by encouraging the content authors and producers to adopt a more end-user friendly IPR scheme, the initiative tries to encourage a more open exchange of content.

At present (Spring 2006) the Creative Commons approach and terminology is adapted to the legislation in the following countries: Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, China, Croatia, Finland, France, Germany, Hungary, Ireland, Israel, Italy, Japan, Jordan, Mexico, Netherlands, Philippines, Poland, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, England & Wales, Scotland.

Meanwhile grass roots community driven exchange platforms for videos and streaming media are booming. This can be seen as a further development of the Creative Commons, which is equally community rather than government driven, successful initiatives in comparable domains are flick.r, delicio.us etc.

Government, community and industry should also collaborate further to encourage the development of political as well as technological solutions and means to support creative content production while securing the incentives to do so, for example by encouraging the development of universal Digital Rights Management instruments.

5.5. New models for sharing, contributing and reusing educational contents, and specifically streaming media.

During the eStream Workshop in Leuven in May 2005, the participants acknowledged the fact that there are vast resources available in many countries but that the main problem is the lack of a common centralised reference library to collate or aggregate what is out there and to make materials available for access or downloading.

In this chapter we describe some of the resources represented at the workshop as examples of good practise:

- CSP (Italy): Hyperlink video production, whereby individualised and divergent research is accomplished. A library of about 100 videos available on http://www.hyperfilm.it/eng/index.htm
- Ashcombe School: How to make your own lessons. 82 video lessons available, including language and science lessons on http://www.ashcombe.surrey.sch.uk/Curriculum/modlang/videos.htm
- ICT Holland: how to conceive and make your own video lessons using VideoPoort. Video is processed and used to produce suitable lessons. Students (after a half day's training) are their own producers of video material. See www.ictholland.nl/videopoort/videopoort2.html and also http://webstroom.surfnet.nl/projecten/webstroom2/inholland.htm
- Beeldbank produces professional video and e-streaming resources for education. These are freely available at the following website (in Dutch) http://beeldbank.schooltv.nl In addition, other websites, which provide educational resources are http://nab.hoofdwerk.nl/start.php and http://www.ebu.ch/en/television/co_production/jibs.php as well as resources provided by Channel 4, RAI (Italian TV) and Wissen (Germany) (mostly fee-paying services).
- Barcelona and Culture: excellent examples of cultural material (a virtual tour of Barcelona, Antonio Gaudi) on www.edu365.com/canaledu365/ (There are about 1000 videos available on www.xtec.es/videoteca)

- See what teachers can do themselves with some of the technical lessons on: http://homepage.mac.com/vandepaer/hamer.mov or on www.kta.demerodelei.be
- http://www.thedirectorintheclassroom.com/onsitework.php
- A streaming video service for the Danish Folkeskole (Primary/Secondary school) is providing access to part of the Danish Broadcasting archive. See www.dr.dk/skole (only in Danish!).
- Moving images in the classroom is a secondary teachers' guide to using film and TV, outlining eight basic techniques and practical activities for the close study of film and television in the classroom which are mapped on to English and eight other curriculum subjects (http://www.bfi.org.uk/education/resources/teaching/secondary/miic/)
- Look again! is an Early Years and Primary teachers' guide to using film and TV, outlining eight basic techniques and practical activities for the close study of film and television in the classroom. (http://www.bfi.org.uk/education/resources/teaching/primary/lookagain/)
- European Educational Broadcasters on content for schools (www.ebu.ch/jibs), the JIBS report contains examples of moving image databases in different European countries.
- A portal about streaming services is at http://video.surfnet.nl/ with a VoD portal and a portal for live streaming (in Dutch only and many channels restricted to the Netherlands, because of rights issues)

6. Emerging standards and standards initiatives

There seems to be a jungle of formats used for encoding streaming media. While people call for standards, it is the competition between the different key players (mainly Apple, RealNetworks and Microsoft) that has resulted in technological progress regarding the quality and capability of streaming technologies. However the downside of this competition is the high number of media formats, which are not always compatible with each other. Always check if the player that you have installed, plays the file format you are receiving, and remember many players playback formats from their competitors.

The Motion Pictures Expert Group (MPEG)

Thanks to the Moving Picture Experts Group (MPEG), the Internet Streaming Media Alliance (ISMA) and the MPEG Industry Forum (MPEGIF) we now have a robust and reliable standard. MPEG is a working group of the International Organization for Standardization (ISO), which is in charge of the development of standards for compressed audio and video. It created the MPEG-1 standard in 1992, the standard used for video on CD and for broadband streaming. This was followed by the successful MPEG-2 standard in 1994, which today forms the basis for satellite and digital cable as well as for DVD production. It is also the basic technology standard for one-way and two-way video over various networks.

In 1998, MPEG-4 was completed, and it provided a video compression standard at rates that target the public Internet. MPEG-4 licensing issues were settled in 2002, and commercial products are shipping in volume now. These MPEG-4 specifications are used by manufacturers and developers to build products for production, encoding and delivery of audio/video content over various types of networks to a variety of clients such as personal computers, personal digital assistants, mobile phones, wireless devices, web browsers etc. MPEG-4 is, to a large extent, based on the Apple QuickTime architecture, but it is an open standard. Open standards foster competition for the best implementation of the standard. The open-standards approach results in a more stable result and help reduce the risk that a single vendor could lock up the technology.

Digital Video

Digital Video (.dv) is the industry standard for processing and storing video on a computer in a binary format. Current digital video cameras are capable of outputting .dv video files directly to a hard drive, where it has become the preferred format for editing and compression. Uncompressed, the file sizes are too big to be transmitted via the Internet.

Microsoft

The Advanced Streaming Format (.asf) is adapted to the MS Windows Media Player file format for audio and video on the Internet or other network. It can contain streaming audio, video, slide shows and synchronized events. ASF is a streaming format and .asf files begin playing before downloading is complete. A similar format is the MS Windows Media File (.wmv), which is used to download and play files or stream content containing audio and/or video.

Audio Video Interleaved (.avi) is the most common bitmap-based format for audio/video data on PC and an example of a de facto standard. Raw .avi files are the result from video capture and a good starting point for editing and compression. .avi files are normally too large for distribution across the Internet, although the format can be used as a container for DivX or Xvid formatted videos.

MS Windows Media Audio (.wma) is an audio format for streaming audio content at CD quality.

Microsoft is also heavily involved in the development of future media standards, promoting the WMV-9 as the candidate for the new video coding.

RealNetworks

RealNetworks Files (.ra, .rm, .ram) are streams that contain live or pre-recorded audio/video delivered directly to a client, such as a web browser. Decompression is done dynamically to allow play back in real time even on lower quality networks.

Apple

QuickTime Movie (.mov) is the Apple media format that allows for streaming and progressive download.

Macromedia

Flash MX Video (.flv) is a Macromedia video format for encoding and compressing video and audio and can be played from within a browser window. A flash file (.fla) can be published directly to the web and becomes an .swf file (ShockWave Flash) that can be played with the widely distributed Flash player. Flash also allows for enhanced functionality and programming elements through the use of ActionScript.

6.1. Media standards, futures and initiatives

Some things are hard to predict -- especially the future. One thing that is certain is that changes are happening quickly in the media world, driven in particular by content providers (TV channels, media producers, value added resellers) who see new markets especially with young people who are not necessarily sitting in front of TV sets.

Streaming media started with single-vendor proprietary techniques such as Real, QuickTime, Windows Media, etc. This was also the case in the early days of television. Television standards emerged quickly, which has contributed to the ubiquitous presence of it. Imagine how different the world would be if you had to purchase a different television set to view each channel or if only one vendor owned the dominant technology that's required to view public broadcasts.

Obviously, industry leaders are working relentlessly to improve their products, delivering better compression on the streaming server side, better decompression and playback on the user side, more functionalities such as access to content channels and online media shopping. This has resulted in an explosive growth of media technologies over the last few years.

As well as these developments, several other significant trends are emerging.

First of all, the handling of IPR and copyright will be a major subject of development and the introduction of Digital Rights Management (DRM) using technologies like digital

watermarks should allow more content owners to join the growing number of streaming media providers. The availability of multiple perfect copies of copyrighted materials is perceived by much of the media industry as a threat to its viability and profitability, particularly within the music and movie industries. Digital media publishers typically have business models that rely on their ability to collect a fee for each copy made of a digital work, and sometimes even for each performance of said work. DRM was created by or designed for digital media publishers as a means to allow them to control any duplication and dissemination of their content. The European Community is expected to create a Recommendation on DRM in 2006. Digital rights management (DRM) is the umbrella term referring to technologies used to enforce controlled (paid) access to software, music, movies, or other digital assets. Many organizations, prominent individuals, and computer scientists are strongly opposed to DRM in its proposed forms: or example the Electronic Frontier Foundation and similar cyber civil rights organizations, also the Free Software Foundation in its GNU General Public License prohibits using DRM to restrict free redistribution and modification of the license-covered works. Their arguments are that the use of DRM may become a barrier to future historians, since technologies designed to permit data to be read only on particular machines may well make future data recovery impossible.

Secondly, network congestion problems are being overcome by distributed content delivery systems that place identical copies of media files on strategically located servers on the global network (for example Akamai or Digital Islands). When a user requests content, the player will look for the optimal place to download from and will even start to download different sections of the file from different servers at the same time. This means that the entire file must be downloaded before playback can begin, but playback quality can be very high. New developments are tending towards a peer-to-peer approach to this method, spreading the file download over a number of PCs to again reduce bandwidth limitations. It is obvious that these solutions require solid mechanisms for the management of rights.

The single most important evolution will be towards streaming on mobile devices. Major developers have already started adopting 3GPP and 3GPP2 as the new worldwide standards for the creation, delivery and playback of multimedia over 3rd generation, high-speed wireless networks, allowing access to rich multimedia on mobile phones, personal digital assistants etc. KDDI, a Japanese mobile phone operator has taken the first steps in its implementation of AMC, which includes MPEG-4 video, QCELP audio, and STML text. With the advent of UMTS and the possible future introduction of IPv6, mobile, wireless videoconferencing will also become more feasible. The development of Scalable Video Codec to fit all solutions (encode once, decode what you need) is promising to deliver from HD down to mobile TV.

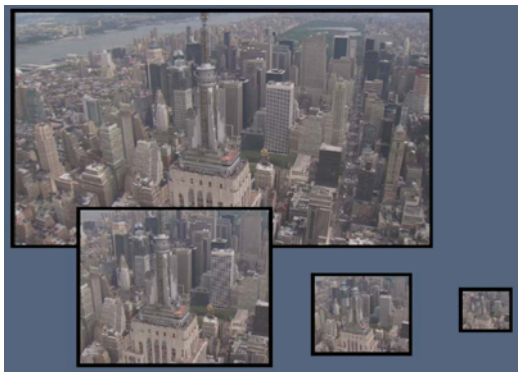


Image courtesy M. Wien, Jan 2006

Scalable Video Coding (SVC) - From Wavelets back to Block Transforms

The SMIL standard for the synchronisation of different multimedia elements allows multimedia producers to enrich the media experience with additional functionalities such as subtitles in various languages, interactive elements, synchronisation with text, audio and slides, etc. The SYMM Interest Group is now the active group within the World Wide Web Consortium (W3C) maintaining the SMIL specification. W3C's Synchronized Multimedia Activity has focused on the design of this new language for choreographing multimedia presentations where audio, video, text and graphics are combined in real-time. The Synchronized Multimedia Integration Language (SMIL) is written as an XML application and it enables authors to specify what should be presented when, enabling them, for example, to control the precise time that a sentence is spoken and make it coincide with the display of a specific image on the screen.

The Timed-Text Working Group, another part of W3C's Synchronized Multimedia Activity, is focusing on the design of a new language to cover all necessary aspects of timed text on the Web. Typical applications of timed text are real time subtitling of foreign-language movies on the web, captioning for people lacking audio devices or with hearing impairments, karaoke, scrolling news items and teleprompter applications.

Another possible future development is the introduction of a metadata standard that dynamically describes events, content and even manipulations related to or even caused by streaming media. Applications that can be imagined are tacit user feedback, adaptive and personalised content, personalised interaction, and even applications of virtual reality. The close integration of Apple's QuickTime with Virtual Reality seems to be a first step in that direction. The evolution of MPEG7 and MPEG21 also seem to pave the way for even richer media experiences providing additional functionalities with media (interactivity). Developments in the AVC, in MPEG and JPEG2000 are also proposing innovative approaches to all these issues, ranging from security over scalability to content description.

One of the newer additions to the video file household is Material Exchange Format (MXF), developed primarily in response to the conversion to digital transmission by the broadcast television industry. MXF is "an open file format targeted at the interchange of audio-visual material with associated data and metadata[11]." MXF has been designed and implemented with the aim of improving file-based content creation. GXF is an abbreviation for "general exchange format", widely accepted by the broadcast

[11] Bruce Devlin, principle research engineer at Snell & Wilcox UK and a member of the standards body, the Society of Motion Picture and Television Engineers (SMPTE)

customers it is now as a standard known as SMPTE 360. AAF (The Advanced Authoring Format) is another file exchange format designed for authoring for post-production.

6.2. Learning and eLearning standards

In many content-creating institutions nowadays, metadata models[12] for eLearning content have been adopted. While the Dublin Core is generally at the foundation of these, in Europe we increasingly see also the influence of the European SchoolNet initiative Electronic Learning Resources, that has proposed a metadata model that can be applied across the board for education at all levels. With electronic resources we mean at this stage "reusable (that can also be modular or portable) learning elements that are clearly distinguishable as individual elements that can be uniquely identified".

On the basis of this metadata model it is possible to define and build formats for the exchange of data (for example XML-data). Thanks to this, it becomes theoretically possible to move learning resources or objects from one Content Management System or Content Repository to another. Thanks to its flexibility and detail, it is possible to describe using the metadata model, all objects, from the tiniest singular object (for example a photograph of a flower) to large and complicated learning resources that are composed out of many elements (for example a pdf version of a course handbook). The metadata model also facilitates easy selection by learning resource type (to accommodate for example different types of CMS or different target user groups (for example teacher or learner).

Although that in theory the above means that if objects are properly defined and described according to such metadata model, it should be easy to search for them, and to view them and acquire them for usage in one's own CMS, this is not always that easy. There are still barriers that need to be overcome.

Not all countries have adopted a countrywide metadata model and some countries still leave it up to the content creators and content repositories to apply a metadata model if they want so. Secondly, language is an issue: content managers select the descriptor language they prefer in their environment: for example many institutions of Higher Education have opted to use the English language instead of the national (or regional) language. Another stumbling block is the absence of a common naming framework: there may be differences between schools, school communities, regions, countries or linguistic regions between the different terminologies used for example subject domains, or for the level of understanding required for certain objects as the teaching and learning may not happen everywhere at the same level at the same age.

The commonly found metadata models collect and record the following key bits of information about the learning resource (note that many of these data are not mandatory, many different variations exist):

1. General metadata (Title, content language, description, keywords)
2. Authoring and lifecycle data (author, editor, publisher, date of publication, expiry date and version number)
3. Catalogue information (classification, theme, ISBN and/or other classification data)

[12] Metadata is simply data about data or supplementary information describing the data.

4. Integration in the learning process (educational level, school type, curriculum coverage, relationship with learning objectives and with supporting handbooks etc.)
5. Technical metadata (media type or format, location, technical specifications, duration etc.)
6. Pedagogical data (type of resource, learning goal, typical time needed for learning, interactivity, target user group)
7. IPR and conditions of use (including cost)
8. Certification (type and source of certification, date and status of certification, accessibility, adherence to standards)
9. Relationship with other learning objects (type of relationship, identifier and description of related object)
10. Annotations

As there is no such accepted standard in this domain, it would be impossible to achieve exchangeability and reusability of learning objects if there were no additional tools or systems available that enable the translation between the diverse metadata models. By representing of all the metadata in an RDF framework[13], it becomes possible to translate towards existing metadata schema standards (IEEE LTSC LOM1.0, SCORM2004 or CEN/ISSS WS-LT SQI1.0) without necessarily adhering accurately to either of these schemes. Resource search mechanisms provided by these will then return meaningful results.

The metadata models do not request any typical streaming media related metadata. One could imagine that there is a certain amount of metadata that would be of interest for these specific media resources, and some of these are effectively being recorded in alternative metadata models such as DAM, MAM and even in some new versions of the MPEG and JPEG standards.

Suggested examples of streaming media metadata may include for example the resolution, the language version (subtitled or not), the format (decoder specification for example), and out of the long list of possible metadata we retain furthermore: title (in English), subject genres, production company and producer credits, year of production, duration, audio, languages, comments regarding language, interactivity, colour system and image speed, display ratio, technical comments, target end user, typical target age, content, script, music data, cue sheet, learning outcomes, difficulty, rights, unit price, submit details.

[13] Resource Description Framework (RDF) is a family of specifications for a metadata model that is often implemented as an application of XML. The RDF family of specifications is maintained by the World Wide Web Consortium (W3C). The RDF metadata model is based upon the idea of making statements about resources in the form of a subject-predicate-object expression, called a triple in RDF terminology. The subject is the resource, the "thing" being described. The predicate is a trait or aspect about that resource, and often expresses a relationship between the subject and the object. The object is the object of the relationship or value of that trait. This mechanism for describing resources is a major component in what is proposed by the W3C's Semantic Web activity: an evolutionary stage of the World Wide Web in which automated software can store, exchange, and utilize metadata about the vast resources of the Web, in turn enabling users to deal with those resources with greater efficiency and certainty.

7. Conclusions

Educational content can be easily shared thanks to the technology of streaming media and the increasing availability of broadband connectivity, by pupils around Europe and the world. They can learn the same subjects and have access to similar content. Streaming media can be beneficial because of the universality of its topics, also because the often limited financial resources to produce individualised content everywhere and because showing pupils images coming from different visual cultures can be educational in itself, not to forget the motivating power of the media.

As already mentioned in the previous chapters, common approaches and standards for the many different issues, related to not only technical aspects, should help advance the effectiveness and uptake of the technology:

- Agreements on a common legal framework and appropriate adoption of rights management
- Metadata that meet the educational needs (but still compatible with the wider technical systems and communities), allowing for indexing, exchanging and searching of content
- The set up of an international body or association to support the advancement of exchanges of streaming media
- Definition of technical standards (including streaming and broadcasting quality standard)
- Definition of target users and the (economical) models of use
- Guidelines for utilisation of moving images into the learning process
- A new methodology for the pedagogical research regarding the use of media
- Commercial issues including the pricing structure and the conditions of usage
- A common understanding and guidelines for adaptation and localisation of content, focusing also on intercultural issues.

In the future we hope that the efforts put in the advancement of the media in education will allow the pupils all over the world to see, experience and learn what otherwise would not be possible in a classroom. The emotional power of moving images could strengthen the learning process.

8. Further reading

8.1. Useful Online Resources

On IPR:

- http://www.surf.nl/copyright/

On New Technologies and New Media Use:

- http://www.videoblogging.info
- http://www.tropisms.org
- http://www.stevegarfield.com
- http://www.mahmood.tv
- http://www.poorbuthappy.com
- http://blogger.xs4all.nl/videorep
- http://groups.yahoo.com/group/videoblogging/
- http://www.youtube.com
- http://www.diverse-video.net

8.2. Further Reading

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JIBS, THE GLOBAL ONLINE MARKETPLACE FOR EDUCATIONAL CLIPS
Pilot phase results, Report edited by Laura Longobardi, Nadège Boinnard, JIBS 2002-2004

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8.3. Examples of National Resources

8.3.1. United Kingdom

Ministry of Education
www.dfes.uk/index.htm

Media Literacy Policy Statement, 2001
www.culture.gov.uk/PDF/media_lit_2001.pdf

A new future for communication – The communication White Paper
www.communicationswhitepaper.gov.uk/pdf/responses/acsp.PDF

National Curriculum Programmes of Study
www.nc.uk.net

The UK Media Education Website
www.mediaed.org.uk

The BFI, British film Institute
www.bfi.org.uk

Centre for the Study of Children, Youth and Media
www.csonline.org.uk/mediacentre

The Media Education Centre
www.soton.ac.uk

Film Education
www.filmeducation.org

UK Film Council
www.ukfilmcouncil.org.uk

8.3.2. France

Ministry of Education
www.education.gouv.fr

"Les TIC dans le scolaire e le supérieur" (documents and guides on the introduction of ICT at school)
www.educnet.education.fr

CNDP
www.cndp.fr

National Education Official Bulletin (1998, number 98-171, September 2)
www.education.gouv.fr/bo/1998/special9/special9.pdf

Blandine Kriegel's Paper "La Violence e la Television"
www.ladocumentationfrancaise.fr/brp/notices/024000584.shtml

CLEMI
www.clemi.org

CRESLEF
http://slhs.univ-fcomte.fr/rech/creslef/page2.htm

8.3.3. The Netherlands

Ministry of Education
www.minocw.nl/english/index.html

Film Classification system
www.kijkwijzer.nl

Media Education in the Netherlands
www.mediaeducatie.nl

Cinekid
www.cinekid.nl

MediaMind
http://portal.omroep.nl/nossites/mediamind

8.3.4. Germany

Ministry of Education
www.bmbf.de

JFF, Institut fűr Medienpädagogik in Forschung und Praxis
www.jff.de

GMK (Gesellschaft fűr Medienpädagogik und Kommunikationskultur)
www.gmk-net.de/gmke.htm

Professor Spanhel's Integrative Curriculum
www.mediaculture-online.de/fileadmin/bibliothek/spanhel_integra/spanhel_integra.html

8.3.5. Finland

Ministry of Education
www.minedu.fi

Finnish Educational system
www.minedu.fi/minedu/education/index.html

Ritva-Simi Merilampi (2002) and all the official documents
www.minedu.fi/minedu/publications/online.html

Finnish Film Foundation
www.ses.fi/en

Child and Media 2000
http://educa.kpnet.fi/kokkola/projektit/c&m2000/enmedia/htm

Centre for Film and Television Education
www.elokuvakeskus.com

8.3.6. Italy

Ministry of Education
www.istruzione.it

Moratti's Reform of Education
www.istruzione.it/normativa/2004/dec190204.shtml

MED-Media Education (projects and documents)
www.medmediaeducation.it

Arrivano i film
www.lombardiacultura.it/spettacolo.cfm

9. Glossary

ADSL	Asymmetric Digital Subscriber Line is a technology for transmitting digital information at a high bandwidth on existing phone lines to homes and businesses. Unlike regular dial-up phone service, ADSL provides a continuously available, "always-on" connection. ADSL is asymmetric in that it uses most of the channel to transmit downstream to the user and only a small part to receive information from the user. ADSL simultaneously accommodates analogue (voice) information on the same line. (source http://www.whatis.com)
Analogue	Information represented by a measurable physical quantity with continuous values, as opposed to information in digital form.
Aspect ratio	This is the ratio of the width to the height on a monitor or television screen. Most TVs and monitors have a 4:3 aspect ratio. The screens are 4 units wide and 3 units high.
Bandwidth	The amount of data per second that can be delivered to your computer. A 56K modem has a bandwidth of 56 kilobits/second. The term bandwidth is also used in conjunction with data rate when discussing video.
Bit Rate	The speed at which binary content is streamed, i.e., travels from one place to another on a computer network, such as the Internet. Bit rate is measured in kilobits per second (kbps). Thus, a 28.8 Kbps modem, for example, can transmit or receive around 29,000 bits per second.
Broadcasting	A means of one-way, point-to-multipoint transmission where the end receiver is not known to the broadcaster, i.e. it is an 'open' system, which does not restrict access to any member of the audience. Broadcasting is typical for radio and television transmission where the audience are only defined by virtue of having the correct receive equipment.
Browser	The programme that finds and displays web pages. Microsoft Internet Explorer and Netscape Navigator are browsers.
Buffer	Space allocated on a system's Random Access Memory (RAM) where data is stored temporarily until it is transferred to another part of the system. In streaming applications, buffers store video or audio data until there is enough information for the stream to be composed.
Caching	Using a buffer within your own computer's fast memory to hold recently accessed data. It is designed to speed up access to the same data later.
Capture card	A device used for transferring video and audio to a hard drive. If the source material is analogue, it also converts it to digital format. If it was digital already, it is transferred to the hard drive.
Capturing	The process of saving video from an external source to your hard

	drive. Analogue video is converted to digital.
Client	A client is a computer running a software programme that requests a service from a server. In the context of streaming, the software running on the client is the player needed to view the stream.
Clipstream™	Clipstream™ is a technology that allows viewing and listening to streaming media without any player. The advantage for the end user is that there is nothing to download or configure. Clipstream™ plays and works on all popular Java compatible platforms and browsers.
Codec	Codecs (or **co**mpressor/**dec**ompressor) work by identifying redundancy in audio and video and removing it. When taking an image of someone speaking in an office, most likely the background around the person remains the same. A codec is designed to recognise this and to only save the parts of the video that change. In this way file sizes can be reduced by as much as 100 times.
Compression	During compression, data that are redundant or unnecessary are thrown away. This makes the file size much smaller, but it may also degrade the quality of image and sound. Smaller files require less hard disk space, less memory to run, and less bandwidth to play over networks such as the Internet. Decompression reverses the result of compression.
Data Broadcasting	Data can be broadcast or transmitted to users over various wireless and cable mediums. The most typical being radio broadcasts (VHF, UHF, satellite) and cable broadcasts (such as simple cable television).
Decoding	Reconstructing an encoded file or data stream.
Decompression	See compression
Digital	Information represented as discrete numeric values, e.g. in binary format (zeros or ones), as opposed to information in continuous or analogue form. Binary digits (bits) are typically grouped into "words" of various lengths – 8-bit words are called bytes.
Digital Rights Management	Digital media files can be easily copied and distributed, without any reduction in quality. As a result, digital media files are now distributed widely on the Internet, through both authorised and unauthorised distribution channels. Piracy is a concern when security measures are not in place to protect content. Digital Rights Management (DRM) enables content providers to protect their content and maintain control over distribution. Content providers can protect and manage their rights by creating licenses for each digital media file. Consumers will also be able to access higher quality digital media content on the Internet because content providers using DRM will be more willing to make such content more widely available. Windows Media DRM is one of the systems that provides end-to-end DRM offering content providers and retailers a flexible platform for the secure distribution of digital media files.
Digital Video	A video signal stored in binary format. To process and store video on

<table>
<tr><td>(DV)</td><td>a computer, it must first be converted to a binary format. Most digital video cameras are capable of outputting video directly to a hard drive in this format via IEEE 1394 interface. DV is a good format to input into a compression and editing application, but the file sizes are too large for effective delivery over the Internet.</td></tr>
<tr><td>Download</td><td>To move a digital file (such as a media file) from a server where it is stored to a local system for viewing or editing.</td></tr>
<tr><td>D-to-A converter</td><td>A device for converting digital signals to analogue.</td></tr>
<tr><td>DVB</td><td>DVB stands for Digital Video Broadcasting, the European standard for Digital TV. This standard provides a very high-speed, robust transmission chain capable of handling the many megabytes per second needed for hundreds of MPEG-2 digital TV channels.</td></tr>
<tr><td>Encoding</td><td>Analysing and compressing a file or data stream.</td></tr>
<tr><td>Frame rate</td><td>The number of frames per second. Higher frame rates should be used to more accurately portray high-motion video. The following table shows some common frame rates:<table><tr><td>Format</td><td>Frame Rate</td></tr><tr><td>Film</td><td>24</td></tr><tr><td>NTSC (USA)</td><td>29.97</td></tr><tr><td>PAL (Europe)</td><td>25</td></tr><tr><td>Web</td><td>30, 15, 12</td></tr></table></td></tr>
<tr><td>Hypervideo</td><td>A type of interactive television technology invented by a company called Veon in San Francisco, California (this company was recently bought by Philips 2001). In essence, Hypervideos are digital video clips embedded with hotspots and markings, links to the web or to other movies and media formats, and/or other triggers leading the viewer in different directions. Veon has created authoring and backend tracking tools that allow the content producer to create these clips using complex object tracking and key frame interpolation algorithms and then track in detail how viewers interact with them. In some ways, this technology is closer to the ideal realisation of interactive TV as it allows the fabric of the video to become completely dynamic. At the moment, this technology is only available over digital broadband networks. A competitor, ISurfTV, develops similar technology; although their authoring tools focus on key frame interpolation and 3D techniques .</td></tr>
<tr><td>Intelligent stream</td><td>A type of streaming that detects network conditions and adjusts the properties of a video or audio stream to maximise quality.</td></tr>
<tr><td>Internet</td><td>A decentralised, global network. The World Wide Web is only a part of this network. Other components of the Internet include email, news servers, Gopher and Telnet.</td></tr>
<tr><td>Intraframe</td><td>A spatially compressed frame (see spatial compression).</td></tr>
<tr><td>Intranet</td><td>A localised, private network based on the same technology as the</td></tr>
</table>

	Internet.
IP	Transmission Control Protocol/Internet Protocol. TCP/IP is the de facto protocol for sending and receiving information over the Internet.
IP/TV	IP/TV delivers desktop video to networked computers by broadcasting both live and prerecorded video. It uses IP Multicast technology so that a single stream of video can be delivered to numerous PCs simultaneously.
LAN	Local Area Network
Player	Software running on the client to view a stream.
Mirroring servers	Network server maintaining an identical copy of its files in (a) another network server, or (b) a redundant drive in the same server. Note: Mirroring can be used as a rudimentary backup system for the original files, but is more often used to spread out the access load for popular web sites by offering users several different locations from which identical files can be accessed.
MPEG	MPEG is the "Moving Picture Experts Group", working under the joint direction of the International Standards Organization (ISO) and the International Electro-Technical Commission (IEC). This group works on standards for digital video compression and file formats. The purpose is to standardise compressed moving pictures and audio. The most notable current MPEG standards are MPEG-1, MPEG-2 and MPEG-4.
Multi-camera angle or individualised television	This technology allows viewers to control camera angles during live events, select which commercials they want to watch, and generally control a selection of choices content producers provide as part of the broadcast. eCommerce and interaction with those commercials is possible. At the backend, servers collect choice information and offer viewers further selections based on those choices.
Multicast	A one-to-many client/server connection in which multiple clients receive the same stream from a server. To receive a multicast, a client *listens* to a specific IP address on a multicast-enabled network, like tuning a television to a specific channel. In contrast, a unicast is a one-to-one connection in which each client receives a separate stream from a server. Multicasting is a technique whereby information is transmited to a well-defined and controlled group of users on your network.
Narrow-band	A low-bandwidth (low capacity) communications path. Narrow-band networks are designed for voice transmission (typically analogue voice), but which have been adapted to accommodate the transmission of low-speed data.
Network congestion	When data being sent on the network has flow control problems between source and destination (e.g. data packets are lost), it results in network congestion.
NVOD or Near Video On	The service of providing a movie to subscribers on multiple channels and staggering its start time (for example every fifteen minutes).

Demand	Subscribers can then tune in to the next available showing.
On demand	The ability to request at any moment video, audio, or information to be sent to the screen immediately by clicking on the appropriate position on the screen.
Open source	Open source is a term used to refer to software with accessible source code and a set of pre-defined distribution criteria. A complete definition can be found at http://www.opensource.org
PoP (Point of Presence)	The specific physical place where you make connection to the Internet.
Progressive download	Progressive downloads are an HTTP/FTP-based delivery method in which the entire video is downloaded to the user's machine. In a progressive download, lost packets are retransmitted until they are received, providing consistently high quality from download to download. Because they rely on the same protocol as web pages for delivery, they are less likely to encounter problems with firewalls than streaming downloads. The movie does not need to be downloaded entirely to start watching it, so it can appear as if it were a streaming file on a fast enough connection. Progressive downloads also have disadvantages. They cannot be broadcast, multicast, or transmit live feeds. The user does not have the possibility to jump ahead to different parts of the movie until it has been downloaded. Finally, limiting distribution or modification of your movie can be very difficult, as the user has the option to save a copy locally.
Proxy	A proxy server is software that acts as an intermediary between a web browser and a web server. To give users rapid access to popular web destinations, ISPs use proxy servers as "holding bins" to store frequently requested pages, rather than going out on the web and fetching them repeatedly from the server on which the content was originally stored.
Real time	The reception, processing and delivery of data in such a way that it appears to be instantaneous.
Server	A server is a computer running a software programme that systematically controls network access and provides the functionality requested by users on the network (e.g. the clients). Basically, a server waits for and then fulfils requests from the clients. In the context of streaming, the server is the software responsible for sending the stream to the client.
SHOUTcast	SHOUTcast is a free-of-charge audio "homesteading" solution. It permits anyone on the Internet to broadcast audio from their PC to listeners across the Internet or any other IP-based network (office LANs, college campuses, etc.). SHOUTcast's underlying technology for audio delivery is MPEG Layer 3, also known as MP3 technology. The SHOUTcast system can deliver audio in a live situation, or can deliver audio on-demand for archived broadcasts.
SMIL	The Synchronized Multimedia Integration Language (SMIL, pronounced "smile") enables simple authoring of interactive

	audiovisual presentations. SMIL is typically used for rich media/multimedia presentations which integrate streaming audio and video with images, text or any other media type. SMIL is an easy-to-learn HTML-like language, and many SMIL presentations are written using a simple text-editor. For a more detailed description of the goals of the SMIL language, see http://www.w3.org/AudioVideo/Overview.htmlthe W3C Activity Statement (http://www.w3.org/AudioVideo/Activity.html) on Synchronized Multimedia; a regularly updated report to W3C members that is also available to the public.
Streaming	Video or audio transmitted over a network that users can begin to play immediately instead of waiting for the entire file to download. Typically a few seconds of data is sent ahead and buffered in case of network transmission delays, (although some data is buffered to the hard drive, it is written to temporary storage and is gone once viewing is complete).
Two-way	Operating method in which transmission is possible in both directions of a telecommunication channel.
Unicasting	Data is delivered to only one user within a network as opposed to multicasting. Each packet in a unicast contains a user ID number. The user ID must match the ID in the header of the unicast packet, only then can data be received.
VDO Live	VDO Live Player is a programme used to view streaming video on the Internet. It is an old programme and rarely used.
VIP	Video Over IP
VOD	Video-on-demand. VOD is pre-recorded video stored on a server for access at the user's convenience. Vcast is an example of a programme that can provide VOD.
Webcasting	Webcasting is a combination of push and smart-pull technologies that allows users subscribe to individual web pages or entire web sites. It also allows for the broadcast delivery of multimedia information (like streaming audio). Microsoft uses the term webcast together with their new Internet Explorer (ver. 4.x)and Netshow technology, Netscape uses the term NetCast with their browser and plugin technology (ver. 4.x). Webcasting consists of three distinct tiers: Subscriptions (basic webcasting, smart pull): You subscribe to a URL (web site) and the selected web pages (from this site) are downloaded and/or updated automatically in the background (for later cache browsing). Channels (managed webcasting): In this context, channels are web sites that offer a special information file that will start a subscription wizard in the browser. Casting (true webcasting, or true push technology): Live Video and Audio streaming. Sometimes also referred as MultiCast - ill suited because media streaming might use unicast (today) and multicast (today and in the future) transport networks.


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