Enriching the curriculum with media

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Introduction
Images or media in general play an important role in medicine. Microscopy, radiography and endoscopy are techniques that produce an enormous amount of images every day. They mainly serve diagnosis, follow-up and documentation. These images enable us to understand structure and functioning of the human body as well as to recognise and observe abnormalities induced by pathological processes. As a consequence, numerous image atlases exist which explain these images and their interpretation. Most of these atlases are books. Some are available in a digital format on CD-ROM or on Internet.

The printed atlases have a number of important disadvantages. Usually, they are expensive, heavy and bulky. Due to the printing process, the prize is high which prevents most students from buying such atlases. Normally, these books have a monohierarchical structure, ie they use one principle to organize the content, eg by localisation or by disease. The search for images is only supported by a table of contents and/or an index. This is neither an effective nor efficient way for finding images. Another disadvantage of these atlases is that they are often restricted to one modality, ie they contain only radiographs or endoscopic images. This is also true for most digital atlases. Links between images of different modalities are rarely offered.

An ideal media atlas is structured polyhierarchically and spans modalities. Polyhierarchical means that the media can be accessed by different organizing principles. The most used organizing principles are anatomical localisation and disease. Other possible organizing principles are functional systems such as immune defence, or clinical symptoms and signs such as chest pain. A search with the term cough would ideally reveal chest radiographs of pneumonias, bronchitis and lung cancer, but also a stained sputum, a video of a bronchoscopy, macroscopic images of lung cancer from an autopsy as well as an audio file of whooping cough.

The vision of an interactive collection of medical media

With the ideal media atlas and the great didactic value of images and other media in mind, we started the project “MorphoMed”\textsuperscript{1} in 1999.

We focused on the following principles:
- The image and/or the medium is the centre piece. Students shall look for theoretical knowledge primarily in books and other text based resources
- Several interactive functions shall promote the learner’s engagement with the media
- A uniform graphical user interface (GUI) for all modules to avoid learning of GUIs instead of content
- Use of web technology that works on CD-ROMs as well as on the Internet
- Production and maintenance of the modules ask as little effort as possible

In fall 2000, we started with a “digital slide box” of histological images (figure 1). The feedback by students and teachers was very positive. Every year, MorphoMed was improved with new

\textsuperscript{1} MorphoMed http://e-learning.studmed.unibe.ch/

Figure 1. Screenshot of a standard page in the histology module of MorphoMed.
images and new features. Anatomy was added in 2002, neuroanatomy in 2003. New features were a magnifying glass function, an archive to search for images, a printer friendly layout, a quiz and sensitive images, which indicate the name and the extension of a structure after mouse contact. The latest improvement consists of a layout that displays two images within one window, which enables direct comparison of images (figure 2).

In parallel, other modules of image and media rich areas of medicine were and are developed using the same technology and the same GUI. One example is the module on interpreting ophthalmoscopic images with a quiz, in which the fundus is viewed through the pupil and can be moved with the mouse (figure 3)\(^2\). The realization of a clinical endocrinology atlas is in process. The same is true for the modules on indicating and interpreting radiographs of the thorax and the skeleton. A module for pathology is planned. A module on otoscopy, laryngoscopy and endoscopy of the gastrointestinal tract and the lung are on the wish list. Also “HemoSurf”\(^3\), a training program on the interpretation of blood films developed in the nineties, shall be transferred into this format. With a module on the auscultation of the heart, we will integrate audio files and realise the idea of an “acoustic atlas”. A first version of this module should be ready this fall.

Production and maintenance over the web

The production and maintenance of so many modules is only possible, if the work flow is optimised and the work load is distributed among many people. This was made possible by a web backend, developed with the Open Source programs PHP and MySQL. This backend allows the authors to create and/or delete pages, to edit text, to upload and/or delete images and to change the sequence of the images via a web browser. The backend can be opened directly from within the module. The allocation of access rights and the modification of the hierarchical tree are under the control of the administrator. Due to this backend, the authors can work on their modules wherever they have access to the Internet. Completed modules are handed over to the teachers. They can then update and enlarge their modules on their own.

In the meantime, the online administration tool does not fulfill anymore our demands and needs. Therefore, we started to develop a new tool using another Open Source program called Typo3\(^4\). In contrast to the existing tool, a separate media data base will exist and templates will facilitate the creation of new learning modules.

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\(^2\) Augenfundus [http://e-learning.studmed.unibe.ch/clinisurf/htmls/ophtha.html?clinisurf\(\text{Ø}\)ophtha](http://e-learning.studmed.unibe.ch/clinisurf/htmls/ophtha.html?clinisurf\(\text{Ø}\)ophtha)

\(^3\) HemoSurf (Demoversion) [http://www.aum.iawf.unibe.ch/vlz/BWL/HemoSurf/Index.htm](http://www.aum.iawf.unibe.ch/vlz/BWL/HemoSurf/Index.htm)

An important innovation will be the use of different standards. The data model will be based on DICOM⁵ and the HEAL Metadata Schema⁶. For the indexing we will use MeSH⁷ and where applicable ICD-10⁸. We hope to start using the new tool by the end of the year.

Integration into the curriculum

As mentioned above, very positive feedback and a high utilisation rate by the students confirmed our concept. The annual surveys showed no decrease in utilisation (almost 100% in the second year), as it can often be observed after a first enthusiastic phase. Crucial for this success was the good integration of MorphoMed into the curriculum, eg each chapter of the histology module corresponds with a practical course in histology. This allows the student to prepare and repeat the histology courses. Additionally, all images are taken from the slides they are watching with the microscope. During the practical histology course, students can access the program with computers placed on the same tables as the microscopes. Thus, they can compare what they see in the microscope with the images of the program.

In anatomy, MorphoMed is also used during cadaver sections. Having a touch sensitive SMART board™ with projection of the computer screen next to the section tables, students can oscillate between the cadaver and the SMART board™ to watch and discuss the images and to compare them to the situation at the cadaver (figure 5).

The integration of an e-learning resource into the curriculum is not complete, if examinations are not included. Since 2003, a computer based histology examination (figure 6) is used for the OSPE (Objective Structured Preclinical Examination), which takes place twice per year in the first and second year. A more detailed description of this examination module will be available on the web at the end of this year⁹.

Since last fall, students have the opportunity to send errors they discover from within the program to the authors. Thus, they participate in the process of quality control and develop a feeling of “co-ownership”.

Continuous evaluation

Regularly at the end of the educational year, the modules histology and anatomy are evaluated with a questionnaire. These evaluations¹⁰ give important information on desired new features

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⁵ DICOM http://medical.nema.org/
⁶ HEAL http://www.healcentral.org/services/services-MetadataSchema.jsp
⁸ ICD-10 http://www.who.int/classifications/icd/en/
⁹ Virtopsy http://www.virtopsy.com/
and usage patterns of the students. A much requested feature in the first evaluation was better support for printing. As a consequence, a printer friendly layout was added. But the questionnaires in the following year showed that less than 20% of the students print out big parts of the program. Another much asked feature is the quiz. Introduced in the second version, it has never been big enough. The magnifying glass despite its supposed attractiveness is not much used by the students.

The anatomy and neuroanatomy modules were never used as much as the histology module. The reason might be that these modules do not cover the subject as complete as histology. This will change for the neuroanatomy modules, which were much expanded this summer.

The availability of MorphoMed on CD-ROM was always much appreciated by the students. Usage patterns evaluated with the questionnaire this year reveal that 80% of the first year stu-

dents now rely on the Internet only. While in former years, an annual series of 250 CD-ROMs was produced in advance, in the future CD-ROMs will only be produced on demand.

Future developments

In addition to the development of other modules, it is planned to create a device independent user interface. This interface will automatically adapt to the device and its screen. Thus, the modules can be viewed also with Personal Digital Assistants (PDA) or even smartphones. PDAs are much promoted in our curriculum.

In the area of image based learning, our Institute of Anatomy will try further technologies. Due to a collaboration between the project “Virtopsy” and the Institute of Anatomy, computer tomography can be used for the cadavers planned to be dissectioned. This winter semester, the students will have the possibility to study the bodies reading the slice images before dissecting them. The free Open Source program “Osirix” from the University of Geneva will be used to view the DICOM data sets. With this software, students can go through the body in different directions and create 3D-views. It is still undecided, if these images or parts of it will be integrated into MorphoMed.

Conclusion

Image and/or media based learning is of great value in medical education and is much appreciated by the students. Because of the low reproduction costs and the interactive features, digital media are perfectly suited to support this type of learning. To benefit maximally of the potential of digital image and media collections, it must be possible for the user to search and rearrange the media according to his needs and interests. This fosters the so much wanted interdisciplinary and integrative thinking in medicine.

Reference


11 Osirix http://homepage.mac.com/rosetoantoinel/osirix/index2.html