

Application of Open Source Software for Veterinary Anatomy Teaching

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Article ID: 87

Veterinary anatomy has always been considered the backbone of veterinary science education. It imparts knowledge about origin, form, structure, and function in animals. Since ancient times, dissection-based anatomy teaching has been the most effective teaching method. Anatomy teaching has undergone significant changes to keep up with advances in technology and to cater to a wide array of student-specific learning approaches. In recent time a generalized decline in dissection based veterinary anatomy teaching has been observed due to the implementation of a new curriculum of veterinary anatomy by VCI, legal and ethical issues, unavailability of the ethically sourced cadaver, reduced teaching hour to veterinary anatomy, the reluctance of students as well as a teacher to handle formalin-fixed cadavers and specimens, etc. Even with the introduction of modern instructional technology and improved teaching methods, dissection continues to remain a foundation of veterinary anatomy teaching. Careful dissection coupled with close observation gives the student a concept of the shape, texture, location, relations of structure, and their functional importance. However, veterinary anatomy teaching modules, etc. With the use of web-based technology, students can access learning modules as and when they need without the boundaries of time and location, they can even view dissections in step as many times they need.

Traditional approaches of veterinary anatomy teaching are instructive and encourage a more student passive method of learning, which are in contention with more progressive means that foster active learning. The focus of modern anatomy teaching has changed from "what the students know to what they would do with what they know" In the recent past, dynamic innovations in educational technology and their applications have increased the accessibility and quality of learning resources to students.

Web-based Teaching:



The internet and web-based technology have become an integral part of everybody's life and it influences the way we think, work or learn. The use of web-based educational technology is helping to change the learning and teaching process through new paradigms in instruction as well as delivery to improve the learning outcomes. The proliferation and continued adoption of web-based technology have increased new learning opportunities in veterinary anatomy education outside conventional instructional settings. The new generations of students are well capable to easily access and utilize web-based resources for effective learning outcomes. It promotes independent learning, problem-solving, schedule flexibility, and breaks individual learning style barriers. Research has shown that web-based teaching when used as an adjunct to traditional classroom/laboratory teaching methods increases the student's knowledge with quick and greater retention. The web-based education technology signifies the concept of "sharing is power" instead of "knowledge is power" in the education system. The role of the teacher is changing as it has become easier with advancements in technology to reproduce and distribute teaching resources, making it easier to reach a broader and more diverse group of students.

The development of web-based anatomy teaching modules requires working knowledge of different software, web platforms, and cost-effective accessibility of the software. Most of the software we use for our routine work or development of teaching materials are proprietary software (eg. Microsoft PowerPoint, Microsoft Excel, etc.) that require licensing and thereby involvement of cost. Most of the software used at universities and colleges is proprietary software and for the majority of them used in desktops of departments/laboratories licenses are not procured either due to unawareness or negligence. The use of proprietary software without a proper license is unethical and illegal. High licensing costs, inability to modify, copy of the problems users of proprietary software. The proprietary licensing and cost of software for the development of anatomical teaching materials can be avoided by the use of Open Source Software (OSS).

Universities must consider multiple issues before choosing among software options and should try to use and promote the use of open-source software (OSS) to avoid intellectual property rights (IPR) issues and to reduce annual expenditure on IT infrastructures.

Open Source Software:



The term "open source" refers to something people can modify and share because its design is publicly accessible. Open-source software is software with source code that anyone can inspect, modify, and enhance according to their requirement. As the source code of open-source software can be modified by anyone without any license so they have more control over the software and can use it free of cost. The terms of use are often defined by the General Public Licence.

The use of Open Source tools is gradually increasing due to the principles of openness, collaboration, and interactive knowledge sharing that are prevalent in the education sector. The development in web-based open course content and open access can be said to have kicked off with the advent of open educational resource (OER) initiatives in the early 21st century. Open Educational Resources (OERs) are any type of educational materials that are in the public domain or introduced with an open license. The nature of these open materials means that anyone can legally and freely copy, use adapt and re-share them. OERs range from textbooks to curricula, syllabi, lecture notes, assignments, tests, projects, audio-video, and animation.

Advantages of Open Source Software:

1. **Cost:** For the development of web-based teaching material several software has required the cost of this software is the major hurdle in developing the content. Open Source Software (OSS) is free to download and use which reduces the initial cost of software acquisitions. Open-source software is very efficient; it requires minimal computing power, so old (but working) machines can be recycled for the development of course content rather than discarding the machines.
2. **Availability:** Open Source Software (OSS) is easily available and for most of the proprietary software several open-source alternatives are available.
3. **Eliminate Piracy:** Open source software are free to use and redistribute.
4. **Reliability and Security:** Open Source Software (OSS) is considered more secure and reliable to work.
5. **Flexibility:** Open source software is customizable according to the need of individuals or groups. New features and tools can be imported from the open-source community.

6. **Continuous improvement:** Extensive collaboration ensures that software products keep improving. Programs from different institutions and organizations, along with volunteers, contribute freely to projects.

Table 1: Commonly used proprietary software and their open-source alternatives

Category	Proprietary Software	Open Source Software (OSS)
Browser	Internet explorer	Mozilla Firefox, Chrome
Operating System	Windows	Linux (Ubuntu)
Media Player	Windows Media Player	VLC
Image	Photoshop	GNU Image Manipulation Program (GIMP)
Office	Microsoft Office	Libre Office
LMS	Blackboard	MOODLE
	Engrade	OLAT
Animation	Flash	Synfig
Statistics	SPSS	R

Open Source Learning Management System Tools

A learning management system (LMS) is a software application for the administration documentation, tracking, reporting, and delivery of educational resources to learners. The educational resources delivered may include text material, presentations, podcasts, videos, audios, animation images, 3D images dissection video, etc. For a particular topic, the digital resources may be any of the above or their combinations according to the need and suitability of the topic. Through LMS, teachers may create and integrate course material, articulate learning goals, align content and assessments, track students' progress, and create customized tests for students.

Advantages of Web-based anatomy teaching:

The web-based veterinary anatomy teaching can be used as an adjunct to classroom/laboratory teaching. It has the following advantages.

1. **Collaborative Teaching:** An anatomist can collaborate with teachers from other institutions or countries for the development of best-suited content for a particular topic.
2. **Convenience:** With this method, a learner can access the learning resources from anywhere at any time, provided he has internet access. A learner can also learn at his own pace and convenience of time within the academic calendar timeframe. The resources available on the web platform can help the student understand the concept and topics that have been discussed in the classroom and laboratories. The diagrams, videos, flow charts available will help students to develop the habit of independent learning.
3. **Reusable:** The content developed for web-based anatomy teaching is reusable by both students and teachers. The teacher can reuse the material from time to time up-gradation of content whereas the student can reuse the material for quick revision.

Similar to those of several software/applications available for the development of a different type of content, several LMS is available for the creation, management, and delivery of educational resources. The open-source movement has also impacted the education system that resulted in the availability of several open-source Learning Management Systems (LMS). An LMS provides a means for managing, delivering, and tracking online instruction and student outcomes as well as acts as a bridge between instructor and learners.

MOODLE: (Modular Object-Oriented Dynamic Learning Environment) is the most popular open-source Learning Management System (LMS) throughout the world. MOODLE is written in PHP developed on pedagogical principles and distributed under the GNU General Public License of the many available open-source learning management systems (LMS) or content management system (CMS) we have used MOODLE on URL www.vetanatomy.online to create and deliver unit wise learning modules in veterinary anatomy as per MSVE 2016.

The installation, configuration, and creation of modules, management, of course, tracking of student progress using MOODLE does not require much technical knowledge. It is available free of cost and can be helpful in collaborative teaching. The content thus developed is being accessed by students using the android based mobile app and web portal for learning

Learn veterinary anatomy beyond the boundary of the classroom as and when they wish.



Like everything new, at first, people refuse to believe that web-based anatomy learning/teaching can be done, they being to hope that it can be done then they see it has been done.

