

Large Animal VETERINARY Rounds™

MAY 2005
Volume 5, Issue 5

AS PRESENTED IN THE ROUNDS OF THE DEPARTMENT OF LARGE ANIMAL CLINICAL SCIENCES
OF THE WESTERN COLLEGE OF VETERINARY MEDICINE, UNIVERSITY OF SASKATCHEWAN

Learning in the Information Age: Electronic Resources for Veterinarians

By Jonathan M. Naylor, PhD, Diplomate ACVIM, Diplomate ACVN

Information overload is a common complaint. Veterinary information is said to have “exploded” in the last 50 years and is expected to continue expanding. A more positive corollary is that tools to manage information and methods of learning have also improved. This edition of *Large Animal Veterinary Rounds* focuses on electronic learning (E-learning) aids for veterinarians and practical strategies to sift, collate, and store information.

As veterinarians strive to keep up-to-date with advances in veterinary practice, they often ask what texts would make the greatest contribution to their practice library. When faced with a difficult case, they may phone a colleague for their opinion or their College library to ask for a literature search. Recent advances in communication have added new resources to answer these concerns. Before discussing these, some general theories about learning may help identify where these new resources are likely to be most helpful.

Methods of learning and the evaluation of E-learning tools

One theory of learning implies that retention of knowledge improves with the number of senses stimulated and the degree of mental involvement in the learning process (Figure 1). Older methods of learning often score poorly on this scale. Traditional lectures, where the professor verbally recites a synopsis of facts while the student copies the information, stimulate few senses and provoke little mental involvement. The degree of complexity in this task can be increased if the student has to mentally summarize the information before transcribing; however, new technologies are offering better learning methods. Computer-based presentations provide an easy method of displaying and controlling different types of material. Consequently, a variety of sensual stimuli can be used to improve retention. In addition, computer-based presentations offer a means of establishing relevance by incorporating recorded clinical material into the presentation.

Relating words to actual images or sounds is another difficult problem with purely verbal or text-based descriptions. With paper-based books, this can be partially rectified by annotated diagrams or images. However, traditional books have no method of reproducing sound and have difficulty reproducing movement. As a result, meaning is lost and learning is misdirected. For example, an evaluation of the ability of veterinarians to describe and interpret common equine heart sounds found a lack of a common vocabulary, but not a lack of vocabulary. In other words, wide varieties of words were used, often inconsistently. Occasionally, veterinarians used the same word to describe completely different findings;¹ in addition, there was a lack of interpretive skills. In the case of arrhythmia, interpretation was related to the limitations in the ability to time sounds. In contrast, findings on diagnosing murmurs from auscultation was limited by skill.²

Adoption of new technologies has been understandably slowed by a lack of objective data supporting their use in veterinary education. A systematic review of dental learning studies found



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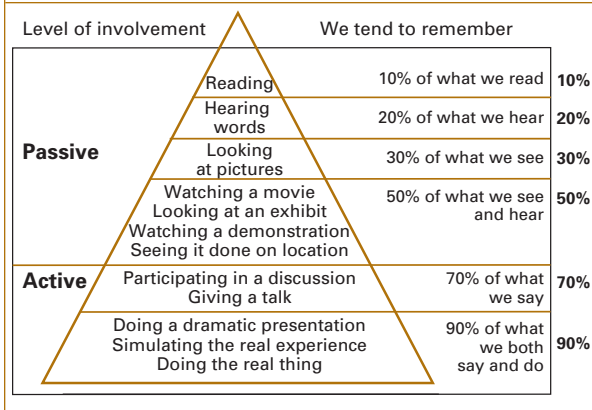
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The editorial content of *Large Animal Veterinary Rounds* is determined solely by the Department of Large Animal Clinical Sciences, Western College of Veterinary Medicine



The Canadian Veterinary Medical Association recognizes the educational value of this publication and provides support to the WCVM for its distribution.

Figure 1: Relationship between learning and method of information presentation: Felder's CONE of Learning



From Dr. Richard Felder's Teaching Effectiveness Workbook, developed and revised by Bruce Hyland, from material by Edgar Dale.

12 randomized, controlled comparisons of computer-assisted learning versus any other method of instruction. Computer-assisted learning resulted in improved outcomes in 5 trials and equivalent outcomes in 6 trials. In only one trial was the outcome better in students taught by the seminar method.³ Many comparisons of computer-assisted multimedia strategies in learning about human medicine use alternatives that are often highly visual or interactive methods involving the use of simulations and lifelike models.

Comparisons of traditional and computer-based learning in veterinary medical education are less common. In a crossover experiment with veterinary students learning orthopedic radiology, students were assigned to case-based instruction with both radiographs and a typed text or to a computer-based multimedia module using text, hypertext links, and digitized images. There was no difference in outcome as measured by performance on an examination of radiographs. Most students (90%) preferred the computer module and liked the incorporation of concepts and links in the computer module. Interestingly, in the 10% of students who preferred traditional instruction, some suggested that this method was more realistic;⁴ however, this perception may change with the introduction of digital radiology.

We recently completed a comparison of a computer-based instructional program versus traditional laboratory demonstrations for teaching students how to pass a nasogastric tube in the horse. Consenting members of the WCVM Class of 2005 were randomly assigned to 1 of 2 instructional methods. The computer group spent an hour with the multimedia CD "Passing a Nasogastric Tube in the Horse," which explained the indications, anatomy, and technique for passing a nasogastric tube. The traditionally-instructed group received similar material from an experienced instructor who demonstrated the material with a live

horse in a 1-hour time slot. Outcomes were evaluated using a Likert scale for student preference, a multiple-choice knowledge quiz, and a videotape of student performance as they passed a nasogastric tube on their own horse. Overall, the students expressed a preference for the multimedia CD, had higher knowledge scores, and successfully passed the nasogastric tube more rapidly when they learned with the computer module than with traditional instruction.

The reasons for superior learning performance with the multimedia CD are not certain. The designers thought that the unique views, eg, the synchronized internal and external views of the passage of the tube and the interactive images testing the correct approach to insert the tube in the nose were positive features. Students also cited the ability for self-directed learning; they could skip features with which they were familiar and concentrate on areas where the material was new. In addition, it was easier for students to see what was happening on the computer screen than in the traditional demonstration.

Electronic learning tools

Reference material

Since information is rapidly being generated, the speed with which it is assimilated into review material is an important step for dissemination into practice. Paper-based texts take about 3 years from conceptualization to production and often, 2 years can elapse between writing the first parts of the text and their publication. E-learning reference material speeds the dissemination of material because it takes less time to print an electronic book onto computer disk (CD) than it does to produce a paper book. Since there is less physical value attached to the plastic in a CD, it is feasible to update electronic books frequently. One equine electronic reference text is published 4 times a year.

Electronic books: For veterinarians practicing on large animals, a number of CD-based texts have recently become available. Many of these focus on areas where there is a heavy visual or auditory component to learning and exist purely in digital format (usually a CD). They tend to be produced by small independent publishers (Table 1). One excellent example of the potential visual advantages of books on CD is *The Glass Horse*. Paper-based anatomy books often use text to describe complex 3-dimensional organ relationships. These can be difficult to comprehend, visualize, and retain. *The Glass Horse* is a heavily visual reference work of equine gastrointestinal anatomy. Images are often represented in 3-dimensions and they can be rotated in any plane in order to see the relationships between different organs. Practicing veterinarians are likely to consult an equine anatomy text when treating or diagnosing a colicky horse. *The Glass Horse* has video constructs showing the development of equine colic due to a number

Table 1: A guide to examples of large animal veterinary reference books that exist only on CD			
Title	Editor/Author/Producer	Publication Information	CD Content
<i>Ageing of Horses</i>	Knottenbelt DC	Scotland, UK: CLIVE Production; 1997	Text, images
<i>Cattle Claw Care</i> Ed. 1.1	Clark C.	Saskatoon, SK: Vet Visions; 2004	Bovine foot diseases. Text, images
<i>CD-Equis</i>	Brown A. (Multi-author)	New York: Vetstream Inc; 4 times a year	Equine medicine text. Text, images, audio, video.
<i>Equine Client Handouts</i>	Ricketts SW, Carson DM.		55 topics for equine veterinarians to give to clients; can be personalized
<i>Equine Reproductive Ultrasound</i>	Dickie A.	CLIVE	
<i>Incisor and Molar Malocclusions</i>	Rucker BA.	R & R Productions; 2004	Instructional video (DVD). 3D Motion. Anatomy, chewing, ageing, malocclusions, tooth nomenclature, dental examinations
<i>Lameness In Dairy Cattle associated with Fusobacterium necrophorum infection</i>	Murray RD, Woldehiwet Z.	CLIVE Liverpool: University of Liverpool; 1998	Interdigital necrobacillosis
<i>Passing a Nasogastric Tube in the Horse: A Self Learning Module</i>	Naylor JM, Abutarbush SM.	Saskatoon, SK: Vet Visions Inc; 2004	Text, images, audio, video, interactive animations, self-assessment quizzes
<i>Questions and Answers Equine Cases and Anaesthesia</i>	Knottenbelt DC, Clutton E.	CLIVE	Twenty case studies plus questions
<i>The Art of Equine Auscultation, 2nd Ed.</i>	Naylor JM.	Saskatoon, SK: Vet Visions; 2001	Cardiovascular, respiratory, GI auscultation findings and interpretation, text, images, audio, video, self-assessment quizzes. English & Italian. ¹
<i>The Art of Bovine Auscultation</i>	Naylor JM.	Saskatoon, SK: Vet Visions; 2003	Cardiovascular, respiratory, GI auscultation findings, interpretation, diagnosis, treatment. Text, images, audio, video, self assessment quizzes.
<i>The Equine Foot</i>	Homes J, Summerlee A.	Guelph, Ontario: Lifelearn; 1995	Text, images, video. Foot anatomy, navicular disease, laminitis
<i>The Glass Horse</i>	University of Georgia	Watkinsville, GA: Glass Horse LLC : 2001	Equine gastrointestinal anatomy, text, 3-D images, audio, video
<i>The Glass Horse Elements of the Distal Limb</i>	University of Georgia	Watkinsville, GA: Glass Horse LLC : 2004	Equine limb anatomy, text, 3-D images, audio, video
<i>The Horse's Foot</i>	Ricketts S, Head M, Payne R, Curtis S.	Guelph, Ontario: Lifelearn; 2003	Text, images, video, narration (cannot be controlled). Anatomy (draws heavily on <i>The Equine Foot</i>), hoof diseases
<i>The Individual Fertile Cow</i>	Noakes D.	CLIVE	
<i>Ultrasonography of the Reproductive System of the Cow</i>	Carrière P, DesCôteaux L, Durocher J, Harvey D.	Montréal : Université de Montréal; 2005	Text, images, videos, 3D animations, diagrams, quiz. English, French, German, Spanish. ¹
<i>Upper Airway Examination of the Performance Horse</i>	Holcombe SJ, Tu L.	Guelph, ON: Lifelearn; 2000	Basic anatomy, physiology and common diseases
<i>Surgeries of the Abomasum in Cattle</i>	Desrochers A, Harvey D.	Montréal : LITIEM; 2002	Bovine abomasal disease, diagnosis, treatment. Text, images, audio, video. English, French, German, Spanish. ¹

CLIVE = Consortium for Learning in Veterinary Education; LLC = limited liability company; LITIEM = Laboratoire d'intégration des technologies informatiques en enseignement médical ; ¹ Language versions available.

of causes, the displacement or disturbance can be seen at any stage and the development traced. These images can be used when advising the owner about what is happening to his horse.

The second CD-ROM from *The Glass Horse* group is entitled *The Glass Horse – Elements of the Distal Limb*. It deals

with the basic anatomy of a horse leg below the carpus and tarsus. Overlapping layers of tendons and ligaments can be removed with a mouse click to reveal deeper structures. The organization of the main menu is excellent and information provided in the individual sections offers more than the basics in lower limb anatomy.

Title	Editors	Publication Information	CD Content
<i>Cardiac Auscultation and Phonocardiography in Dogs, Horses and Cats</i>	Kvart C, Haggstrom J.	Uppsala : Clarence Kvart; 2002	Audio CD of heart sounds; requires book for interpretation
<i>Diagnosis and management of lameness in the horse</i>	Ross MW, Dyson SJ.	Philadelphia : Saunders; 2003	Video of gait abnormalities, self explanatory
<i>The Merck Veterinary Manual</i> , 8th ed, CD	Aiello S, Mays A, Benzel HA.	Whitehouse Station, NJ : Merck & Co., in cooperation with Merial Limited; 2000	Complete text plus additional images
<i>The 5-Minute Veterinary Consult: Equine</i>	Brown CM, Bertone J.	Baltimore, MD : Lippincott Williams & Wilkins; 2002.	PDA version, requires 4 Mb memory, does not run on a PC
<i>Veterinary Drug Handbook</i> , CD.	Plumb DC.	White Bear Lake, Minn: PharmaVet Publishing; 2002	Text
<i>Veterinary Ophthalmology Essentials</i>	Grahn BH, Cullen CL, Peiffer RL.	Philadelphia: Butterworth, Heinemann; 2004	Supplemental quiz with images and audio interpretation

Examples of the potential audio advantages to CD-based reference books are my (Jonathan Naylor) books on large animal auscultation, combining text, audio, and visual components. One unique aspect in these books is the use of video because it allows the precise superimposition of veterinary terms with important audio or video features (eg, a murmur, or a cow with a positive grunt test).⁵⁻⁷ These features make it easier to relate text descriptions to clinical findings and reduce the likelihood that terminology will be inappropriately used. Favourable reviews have described this effort as a “unique and practical educational tool”⁷ and suggested, “equine practitioners seeking to hone their auscultatory skills could do no better than to listen to this CD.”⁶

Paper books with an electronic component: There is a growing trend to release texts in both a paper and electronic format (Table 2). This tends to reduce publication costs with very large books, provide a readily portable form of reference material, and is a way of providing supplemental colour images, video, or audio. *The 5-Minute Veterinary Consult – Equine PDA* is an example of a portable reference source. The text comes as a CD that can be downloaded onto various handheld personal data organizers as a portable reference source. *The Diagnosis of Lameness in Horses* comes with a CD containing a video of gait abnormalities.

Non-veterinary electronic reference information sources: Two general sources of information deserve a mention. Many encyclopedias now come on a computer disk to save paper printing costs and provide a more convenient reference source. The DVD version of the *Encyclopedia Britannica* contains 54 million words on a single DVD. Newspapers are beginning to be delivered electronically. This format allows more consistent, timely delivery to remote locations; the format also

tends to be less expensive and solves the problem of what to do with old newsprint. As a result, with a laptop and wireless network, you can read the newspaper anywhere in your home.

Searching for scientific articles

In the information age, tools to sift, rank, and retrieve information are crucial for finding original data. Formerly, this task was performed by individuals who read the literature, summarized it, and filed a synopsis. Usually the filing system was personal and papers were filed with only one or two headings, although more sophisticated systems were available to allow retrieval based on a series of keywords. This task became centralized with the introduction of large abstracting agencies (eg, Index Medicus for science related to human health, the Commonwealth Agriculture Bureau animal database, and Biological Abstracts). These large databases soon added the ability to search topics using a variety of key words. Today, these large databases are stored on-line, which speeds the search process. In addition, electronic abstracts have been added to many databases allowing the instant retrieval of an article summary. In fact, many older abstracts have been converted into an electronic format. These computer-based abstracting and key word services make it possible for a veterinarian to obtain information about a wide variety of veterinary and general health issues on-line anywhere in the world. Unfortunately, access to the Commonwealth Agriculture Bureau database, which has an animal and veterinary orientation, is generally only available on a fee-for-service basis.

One of the best publicly available reference sources is <http://www.ncbi.nlm.nih.gov/entrez/query.fcgi> (www.pubmed.com). Although this is specifically designed as a resource for human health, it contains

many veterinary articles and provides abstracts for most. Once a relevant article has been found, it is sometimes possible to link directly to the full text. Many journals now have an electronic as well as a paper format.

Another useful reference tool is Cornell Consultant, <http://www.vet.cornell.edu/consultant/consult.asp>. This comprehensive, evidence-based site is maintained by Dr. Maurice White of Cornell University, College of Veterinary Medicine. The site allows a search by diagnosis and this approach returns a brief summary of the disease. Even more useful is the “search by signs” feature that returns a comprehensive list of differential diagnoses for a particular collection of signs within a given species. This feature is particularly useful when trying to pinpoint the diagnosis of a difficult case.

Presentations

Classroom and conference presentations: A number of E-learning tools are attempting to rectify problems with traditional instruction. Computer-based presentations are now the method of choice at conferences and in the lecture theater. These are popular because they can be readily updated so it is easier to correct and improve a presentation. Digital images can be readily and inexpensively incorporated. A unique advantage is the ability to add video or sound. This is also possible with traditional presentations, but it usually requires additional equipment. In addition, the ability to control the presentation of a video (ie, to rewind, freeze frame, and replay) is much greater with a computer video clip than with a VCR or movie tape.

Professional discussion groups

As a student, I used to visit the local pub in the evening with my colleagues. We would often discuss veterinary medicine on a peer-to-peer basis. Direct access to a specialist was much more difficult. In addition, the choice was limited and often required an appointment and a half-hour or more wait. Today, many of my peers are remote. However, if I am prepared to wait, they can be questioned directly by E-mail and a reply within 24 hours is likely, even if they live on the other side of the world.

Professional discussion groups are of even greater use. These are available on a membership basis to specialists in most of the American Veterinary Medicine Associations (AVMA).

- The American Association of Equine Practitioners (AAEP)
- The American Association of Bovine Practitioners (AABP)
- Veterinary Information Network (VIN).

All offer E-mail discussion forums for their members. Generally, these operate on a list server basis. Questions or answers are mailed to a central computer that checks for illegal attachments and then mails the question to all members. These E-mail message boards allow practitioners to discuss issues and pose questions to each other about veterinary medicine. Answers are often available within minutes or hours. The questions and information are only as reliable as the source, but some are refereed by paid consultants. They are an excellent way of keeping abreast of current developments or finding new leads to obscure information.

Summary

Many E-learning tools are available to help veterinarians in practice stay up-to-date with the burgeoning veterinary literature. Electronic texts offer more varied and stimulating methods of learning clinical material. They are particularly likely to be beneficial in areas where learning visual or auditory skills is important. Electronic texts also offer a less expensive (if you already own a computer) and lighter way to carry bulky documents, and more rapid and sophisticated methods of searching and finding relevant facts. The big electronic abstracting databases such as *Pubmed* are invaluable for in-depth research about a particular topic. When combined with electronic access to journals, they offer a very rapid method of obtaining the latest information. Professional chat groups and list servers offer a simple way to gain practical experience from colleagues and a way to access experts who may reside in distant locations.

If you would like a copy of this article or review back issues of *Large Animal Veterinary Rounds*, they are all available electronically on the Canadian Veterinary Medicine Association (CVMA) website.

Acknowledgement: Thanks to Dr. Bruce Watts for providing a review of *The Glass Horse and The Glass Horse – Elements of the Distal Limb*.

Gale Parchoma (guest editor), B.Ed., B.A., M.A. in Education is an instructional designer with the Extension Division and a doctoral candidate in the Department of Educational Administration at the University of Saskatchewan. Her research interests include E-learning systems, E-learning policy, learner-centred instructional design, distributed communities of practice, and virtual learning communities.

Dr. Jonathan Naylor graduated from the University of Bristol with degrees in Veterinary Medicine and Biochemistry. He obtained his PhD degree and Board Certification in Internal Medicine at the University of Pennsylvania. He is currently a Professor in Large Animal Clinical Sciences specializing in large animal internal medicine and E-learning.

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Resource websites

CVMA: <http://canadianveterinarians.net/index.aspx>

Direct link to *Large Animal Veterinary Rounds*: http://www.idrounds.ca/cgi-bin/templates/framesets/veterinaryRoundsCa/fs_snell.cfm (Accessed May 16, 2005).

AVMA: <http://avma.org>

AAEP: <http://www.aaep.org>

AABP: <http://www.aabp.org>

VIN: <http://www.vin.com>

Abstract of Interest

The effectiveness of computer-aided, self-instructional programs in dental education: a systematic review of the literature

ROSENBERG H, GRAD HA, MATEAR DW.

Computer-aided learning (CAL), self-instructional programs provide an accessible, interactive, and flexible way of presenting curriculum material. In order to assess the effectiveness of CAL programs in dental education, a systematic review of the published literature comparing CAL with other teaching methods was performed. A systematic search of the published literature was performed. Articles formally assessed for inclusion had to meet the following criteria: randomized controlled trials comparing CAL with any other method of instruction, and the use of academically homogeneous dental students or dental professionals with objective, predefined outcome criteria measuring performance, time spent, and attitudes. The searches located a total of 1,042 articles; of these, only twenty-seven articles met the inclusion criteria. Further quality assessment identified twelve studies that were

included in the final review. Five of the studies documented statistically significant differences in outcome measures (scores on multiple choice, written or oral tests, and clinical performance) favouring CAL over comparison group(s), while six revealed no statistically significant differences. One study documented a greater improvement in test scores in the seminar group over the CAL group. Participants' attitudes towards CAL in the included studies are also discussed. Our study concluded that CAL is as effective as other methods of teaching and can be used as an adjunct to traditional education or as a means of self-instruction.

J Dent Educ 2003; 67(5):524-32.

Upcoming Meetings

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Tel.: (306) 966-7267 or (306) 966-4124

Email: anne.ruholl@usask.ca

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Contact: Tel.: (613) 236-1162

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Email: admin@cvma-acmv.org

Website: www.cvma-acvm.org

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Annual Meeting**

Salt Lake City, Utah

Contact: AABP

Website: www.aab.org

3-7 December 2005

**American Association of Equine Practitioners,
51st Convention**

Seattle, Washington

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This publication is made possible by an educational grant from

Schering-Plough Animal Health

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