Implementation of an E-learning teaching module supports active learning and improves understanding of the regulation of estrous cycle in domestic species.

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Introduction
Veterinary students struggle to understand reproductive physiology due to the large species variation in endocrine regulation of the estrous cycle.

Understanding this subject is difficult when using available texts in books. Attending lectures and classes does not improve the student’s performance. In addition, retention of knowledge in later parts of the study appears to be relatively limited.

Therefore, an interactive on-line module on the comparative biology of the estrous cycle of the cow, sow, mare, bitch and queen has been developed for bachelor students in Veterinary Medicine.

Table 1: Percentage of time spent per student when using the module.

<table>
<thead>
<tr>
<th>Time spent</th>
<th>&lt; 3 hours</th>
<th>3 hours</th>
<th>&gt; 3 hours</th>
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<tbody>
<tr>
<td>Overall response rate is 96.5% (193/220)</td>
<td>6%</td>
<td>27%</td>
<td>67%</td>
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Aim
When students have taken the e-learning module they have knowledge of and insight in:
• the endocrine and paracrine regulation of the estrous cycle.
• the similarities and differences in regulation of the cycle in the five veterinary relevant species cow, sow, mare, dog, and cat.
• the relation between anatomical, physiological and hormonal changes and behavior during the estrous cycle.

Figure 2: Basic principles of production and action of hormones and an example of their possible function in the hypothalamus-pituitary-gonadal axis.

Materials & Methods
The E-course consists of three main sections (Fig. 1). Each section includes interactive modules, integrated knowledge clips, clinical instruction movies, interactive graphics and quizzes with back and forward immediate feedback.

Section 1 provides insight in general principles of hormones (Fig. 2), the regulation of these hormones, their role in the estrous cycle and their effect on the reproductive organs.

Figure 3: Example of an animation of the follicular wave concept in cow with an accompanying quiz.

In the species-specific chapters, students have to actively simulate the hormonal changes during the cycle (Fig. 3). Section 2 addresses physical examination of reproductive organs in relation to the estrous cycle (Fig 4). Section 3 presents representative clinical cases.

The student is encouraged to actively participate when taking the module. In the module the subject material is presented using different formats, making it more comprehensible for the student. Levels of acquired knowledge is tested by quizzes.

Figure 4: In knowledge clips the clinical examination procedure in different species is shown. Afterwards, questions with a feedback option are presented.

Evaluation of the e-learning module
Third year Bachelor students (n=220) were asked to fill out a questionnaire after the course, using a 1-5 Likert scale rating.

Conclusions: Implementation of the e-learning module was very successful!
• The e-learning is highly appreciated as a comprehensive studying method.
• Most students spent more than 3 hrs on this topic, table 1.
• Better prepared students during classes.
• Significantly improved understanding of the estrous cycle as indicated by overall improved test scores.
• Strong demand for similar e-learning modules on other topics in reproduction.

Figure 5: Student survey on usability.

Figure 6: Student survey on appreciation.

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