Teaching Diagnostic Problem Solving: Principles Learned from Studies of the Diagnostic Pathfinder

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Summary and Implications

Three quasi-experimental studies, and a survey-based study examining the effectiveness of and principles embodied in the Diagnostic Pathfinder, a software tool for teaching diagnostic problem solving in veterinary medicine. It appears that when students learn diagnostic problem solving in the context of authentic cases, are required to consider all potentially relevant information that they have identified in their solution, and receive immediate feedback, their ability to solve diagnostic problems improves.

Introduction

Diagnostic problem solving is difficult to teach and to learn. Yet it is critical that veterinarians be competent at diagnosing medical conditions based on information such as history, physical exam and laboratory data. Various strategies, such as using authentic cases and using computer-based practice tools have promise to help students learn these skills. However, it is important to identify the characteristics of such tools that make them effective.

Materials and Methods

The Diagnostic Pathfinder (dP) is a computer based tool that allows students to solve diagnostic problems involving animal patients. The dP involves four core learning interactions: 1. collecting data from the patient history (Figure 1), 2. examining laboratory data to identify data abnormalities (Figure 2), 3. synthesizing data into an outline-based solution called a diagnostic path (Figure 3), and 4. comparing the learner solution to an expert solution (Figure 4).

Four studies involving the use of the dP, and previously reported [1,2] are summarized herein. Three related studies at three different institutions (Virginia Tech, UC-Davis, and UW-Madison), each employed a similar quasi-experimental design to explore the effectiveness of the dP. Equivalent groups of students used either the dP or a similar paper-based process for completing case based homework assignments. Final exam scores on a paper-based, case-based final exam were then compared between groups.

In the related survey-based study, 640 students across 8 semesters of instruction at five colleges of veterinary medicine used the dP to varying degrees to practice case-based homework assignments. Learners responded to a 28 item survey regarding their experience with the dP. Responses to Likert scale for all participating institutions were summarized using descriptive statistics. Open-ended responses were analyzed using an open-coding technique to determine what aspects of the software tool produced its effect, from the students' perspective.

Results and Discussion

In all three quasi-experimental studies, students using the dP to complete their homework scored significantly higher on case-based, paper-based final examinations than students who used alternative methods for completing their homework. Final exam scores, numbers of participants, and p values are shown in Table 1. In the fourth study, students who used the dP overwhelmingly agreed that it increased the amount of laboratory data they considered in arriving at a solution, made their case solutions more precise, improved the effectiveness of the time spent doing homework, and helped them organize their thoughts about the cases. Open-ended response analysis revealed that students believe that the highest learning benefit came from the software's immediate feedback and the fact that the software forced them to consider all abnormal data. Many students also perceived benefit from the software's method of manipulating data while arriving at a diagnostic solution. Several implications for teaching diagnostic problem solving were presented. First, requiring a standard of completeness in data consideration motivated students to be more thorough and sophisticated in their data analysis. Second, providing students with immediate and detailed feedback in the same format in which they communicate their solution improves their learning associated with solving similar diagnostic problems.

Figure 1. Collecting Data from Patient History.

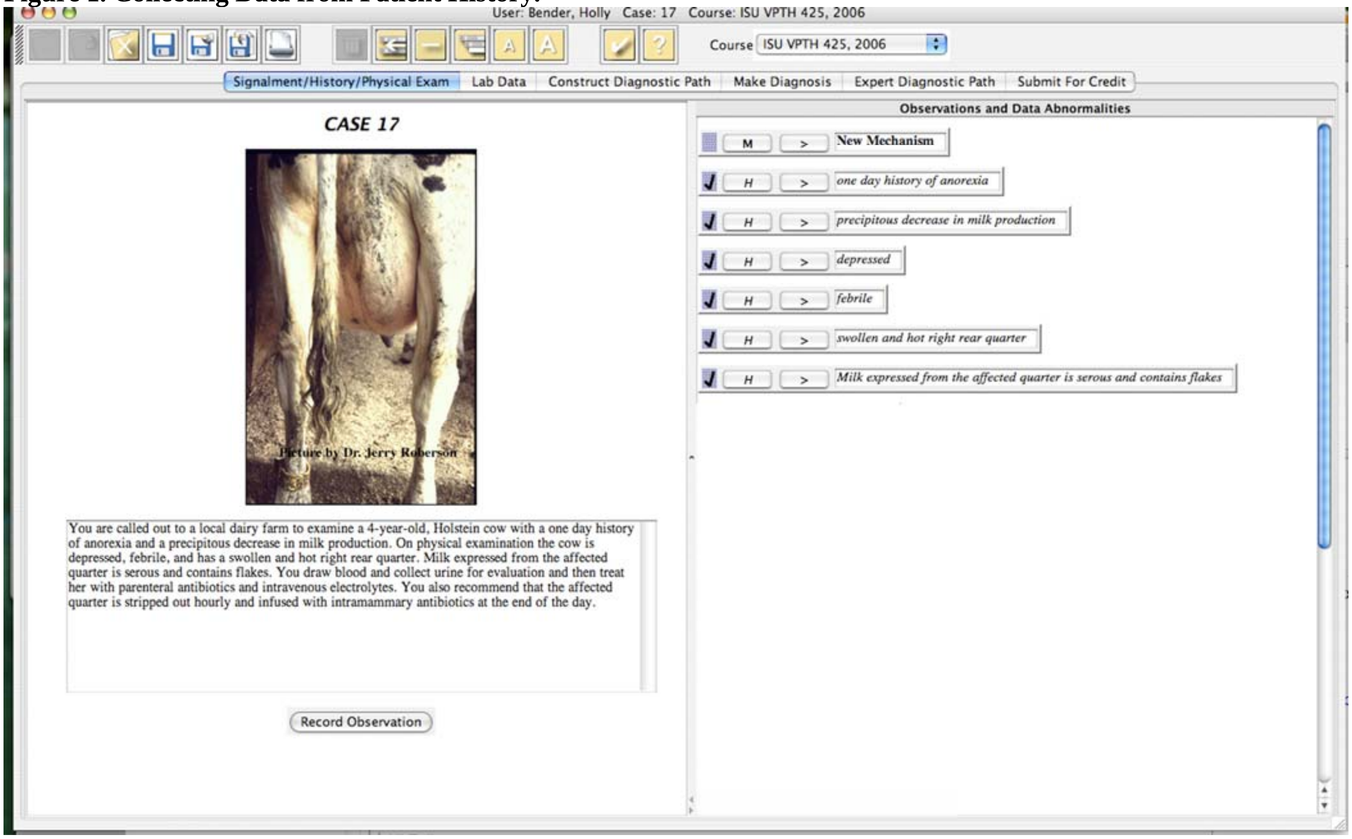

Figure 2. Identifying Data Abnormalities.

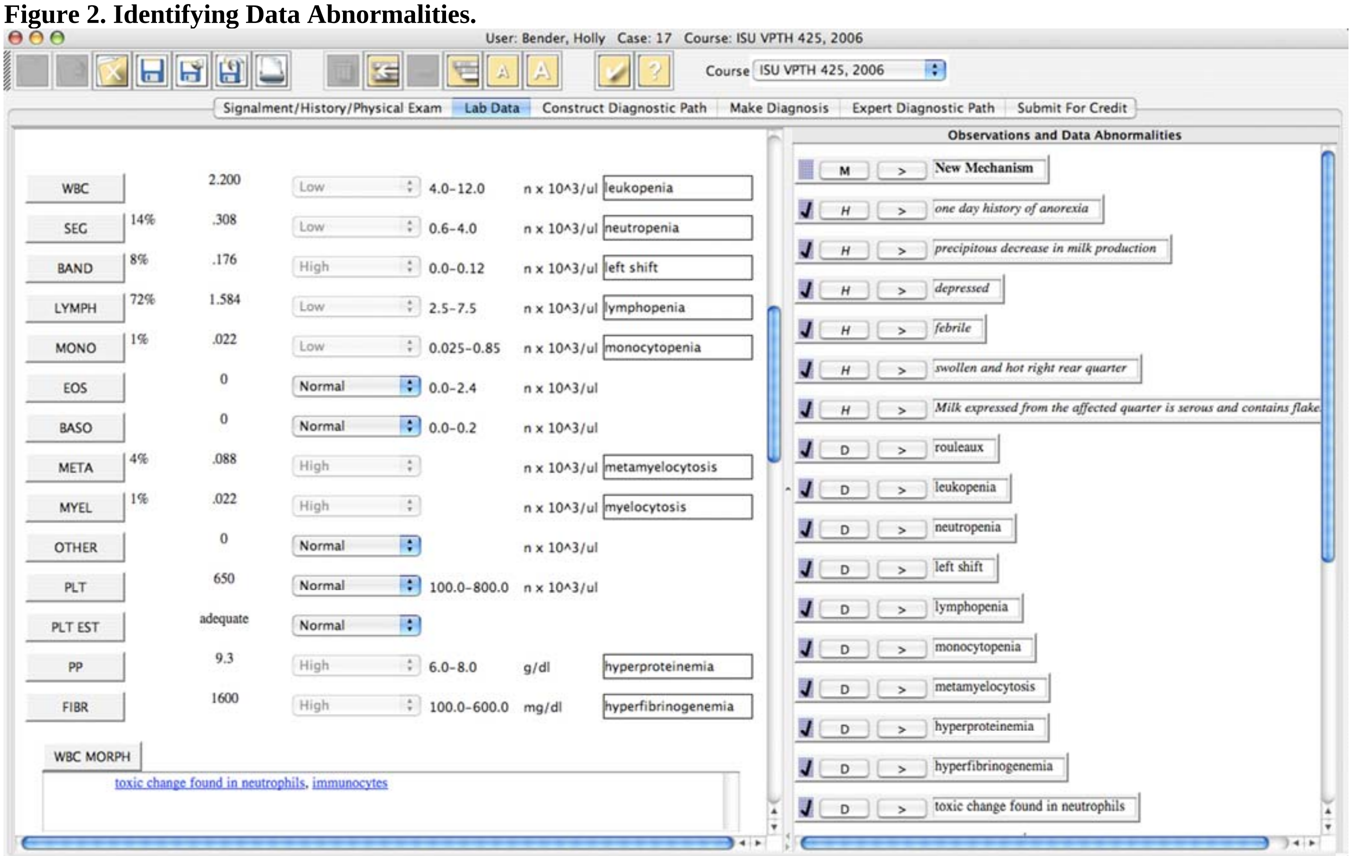

Figure 3. Creating a Diagnostic Path.

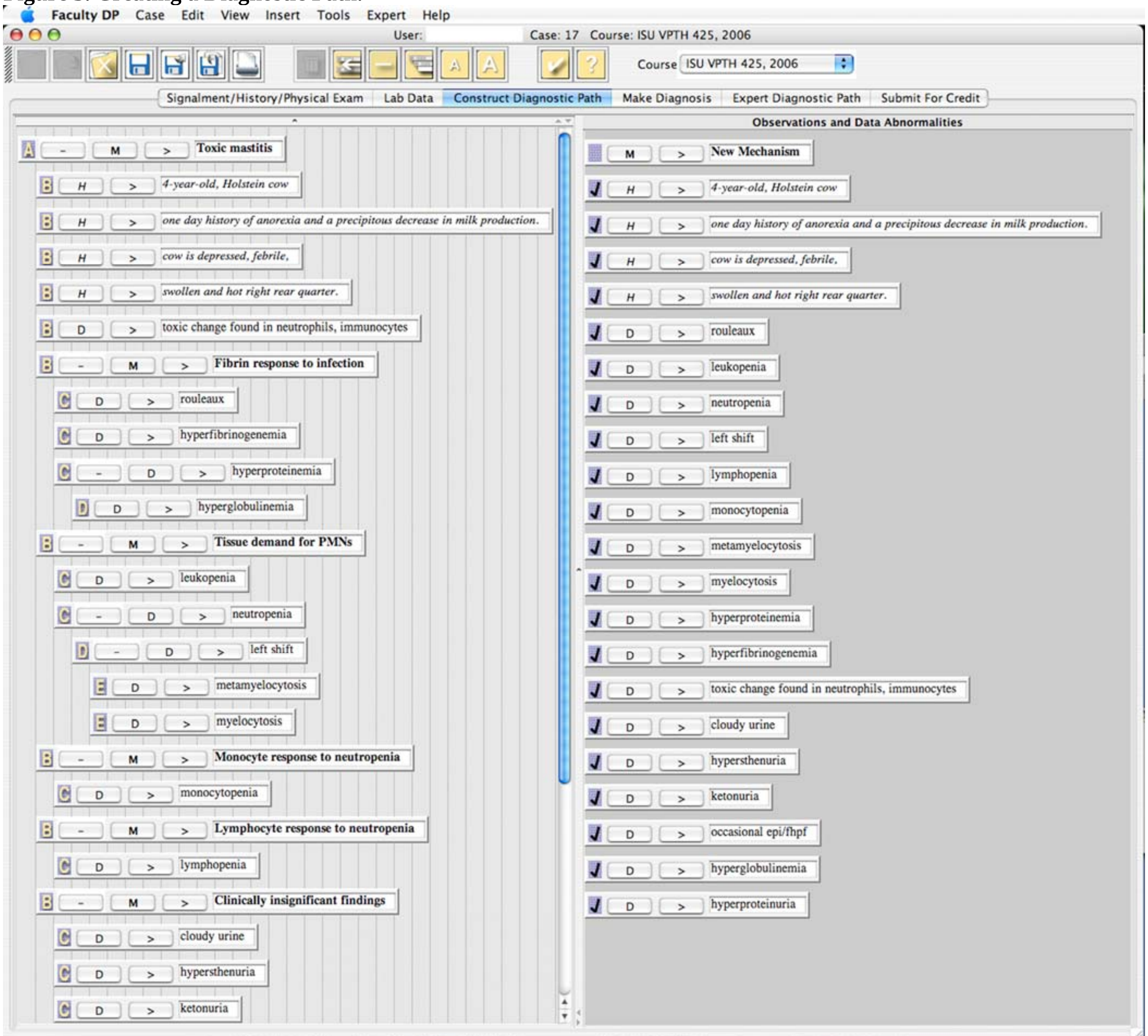

Figure 4. Feedback – Student and Expert Solutions Compared.

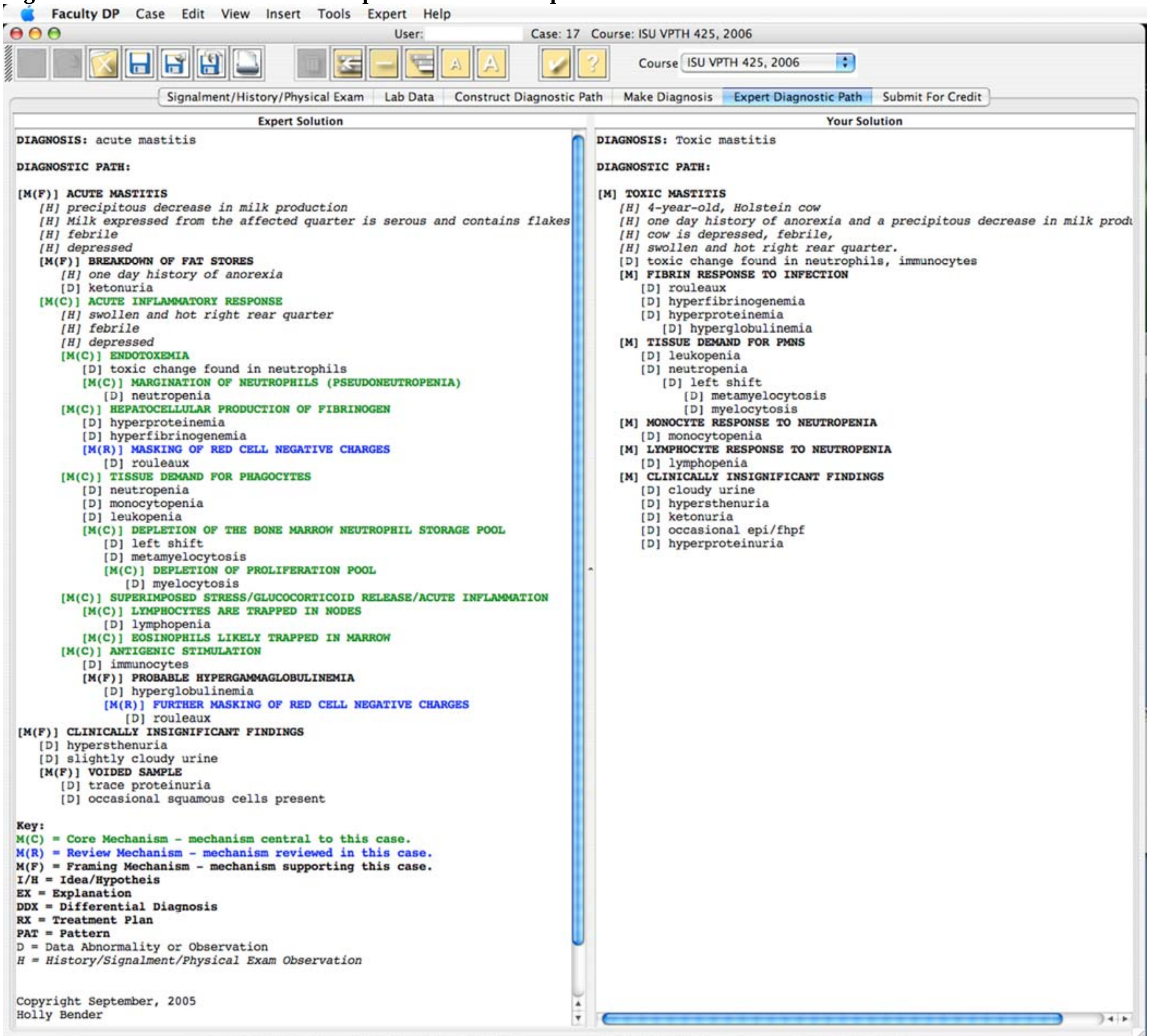

Table 1. Final exam scores for quasi-experimental studies at three institutions.

Institution	Control	DP	Significance
Virginia Tech	81.6 (n=334)	87.3 (n=173)	p < .0005 *
UC-Davis	85.0 (n=120)	90.1 (n=126)	p < .0005 *
UW-Madison	84.7 (n = 199)	87.0 (n = 113)	p = .002*

* Independent Samples t-test

Acknowledgements

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