

DOMAIN 1b: Development of Enduring Educational Materials	
Name: Stephen Hines	Affiliation: WSU Dept. Vet Micro Pathology
1. Educational Product: Identify the impactful educational material you've select to focus on.	
Clinical integration / Card Sorting Exercise: Systemic Pathology Laboratory	
2. Your role(s): Describe your role(s) and specifically what you contribute.	
I designed the exercise, created the sorting cards, packaged them for use, and direct the exercise.	
3. Learners and amount of contact: Describe how the material is being utilized – i.e. specifically where, when (<i>duration/frequency</i>), and by whom (<i>the types, levels and numbers of learners involved</i>).	
130 X 2 nd year veterinary students – implemented in Systemic Pathology laboratory (at both Pullman and USU-Logan campus. 6 different card sorting exercises were created and implemented in 3 different lab sessions. Students are divided into small groups of 3-4 students each. Utilized 4 years and expanded.	
4. Goals and learning objectives: List goals and <u>learning objectives</u> of the educational product. If these are extensive, provide just a few illustrative examples.	
The overall goal was to provide a hands-on, active learning experience (with feedback) by which students could practice their integration skills relative to clinical signs, lesions, and mechanisms of disease for the GI, hepatobiliary, and exocrine pancreatic organ systems.	
Specific Learning Objectives for the GI system included: <i>"You should be able to accurately APPLY your knowledge of common diarrheal diseases to "create an appropriate case" by accurately bringing the components together (diagnosis, clinical scenario, lesion, pathogenesis, and pathophysiology). As part of this expectation, you should be able to appropriately rule-out diseases, clinical scenario, lesions, pathogenesis, and pathophysiology that do NOT appropriately match the other components of the case, and to explain your reasoning."</i>	
5. Methods: Briefly describe the product / materials – i.e. the methods used and how these align with objectives.	
Using 3 way matching (3WM) questions from previous exams, we created 5 sets of cards. Within each set, cards are colored differently depending on whether the statements represented a clinical scenario, a lesion, a mechanism, or a diagnosis/etiology. Together these basically form an "illness script." For a respiratory system sorting exercise, we also developed a set of cards that included glossy prints of gross lesions. Each set of cards was accompanied by a set of instructions (largely the same for each) and a blank answer sheet that provided the roots for each 3 way match. For example, some answer sheets featured a list of 6-8 clinical scenarios, while another might provide the description (or images) of 6-10 lesions. See Appendix for example. Student groups were then asked to match the colored cards to the appropriate root statement and to each other. Importantly with 3WM questions, all 3-4 parts of the match should match all the other parts. So, for example, it might be that a particular lesion could be matched to a particular scenario. However, the corresponding mechanism (e.g. pathophysiology that explains how the lesion produced the clinical problems in a case) might be missing. In this scenario, the students need to look for a more appropriate match that allows them to bring all 3-4 parts of the case together.	
We first applied this method in Sys Path labs in 2012. We've continued the practice every year since and added labs, including experimenting with other variables (such as incorporating pathology images for the respiratory system). Most commonly, these active learning exercises are employed in the last hour of a 2.5 hour lab, but some are more the focus of a lab.	
6. Rationale: Describe why and how you chose the method(s) you used.	
In 2011, one of our WSU CVM Teaching Academy colleagues returned from a teaching meeting and via a local TA seminar reported back about a novel "card sorting" assessment tool. By this method, students are asked to "sort" cards that described biological problems/processes. ^{REF} The education researchers who described the approach had demonstrated how novices tend to sort the cards based on surface features, while "experts" (e.g. faculty) sorted the cards in more meaningful ways based on deep features embedded in each biological statement.	

The sorting concept was demonstrated at the meeting (and for our local Teaching Academy) using cards depicting comic book superheroes. While most of us could only sort the superheroes based on superficial features (male versus female, wears a cape versus no cape, etc.), a few comic book aficionados in the room could sort on much more meaningful criteria (e.g. member of the Avengers versus Justice League of America). The researchers reported that the card sorting exercise was a robust tool to distinguish experts from novices, and suggested that it might be very useful in tracking developing expertise. I immediately saw how the card sorting format could be adapted and applied to create a sorting/integration "card game" by which our students would work in small teams to practice the deep analysis and connection we were seeking to develop. Having completed the sort (or 3 way matches), the students could then consult a key (and/or instructor) to get timely feedback.

Reference: Smith JI, Combs ED, Nagami PH, et al. Development of the Biology Card Sorting Task to Measure Conceptual Expertise in Biology. Campbell AM, ed. CBE Life Sciences Education. 2013;12(4):628-644

7. Results and impact: Describe evidence of learner satisfaction (e.g. student ratings of teaching/course), learning outcomes, application of knowledge in other settings at your institution, impact on educational programs within the institution, and/or teaching awards.

The color cards and small groups engaged the students in ways that the previous versions lifted from old exams never had. Virtually every group spread out the cards on their table, sorted initially by color to set up the framework (see photos in appendix), and then began deep discussions about each statement and where it might belong. Student focus and the level of the conversation were beyond anything we'd seen in the previous 10 years (see Appendix for photos). The instructors and TA's were largely superfluous until the students were ready to check their work against the key or ask about specific matches/mismatches. Although we did not chart performance on exams or 3WM questions compared to previous years, student evaluation comments indicated significantly less discomfort with the 3WM format or the formidable expectation it represented. Similarly, we observed (but did not quantify) a notable decrease in the number of students who struggled with 3WM questions and therefore "tanked" the questions on the exams. At the students' request, the 3WM card sorting exercises were organized into 3 ring notebooks and stored in the student lab for easy access. Especially as the exams approach, many students and study groups practice with additional sorts. They report that this sharpens their skills and helps them learn to recognize the key deep features of each statement.

8. Reflective critique: Describe your reflections, what went well and plans for improvement. If applicable, briefly explain how the information obtained through development and assessment of this teaching activity changed your overall educational practices.

We learned years ago that our 3WM problems very effectively assess our students' abilities to identify deep features of a case and, most importantly, to move past memorization to INTEGRATION and conceptual understanding. The caveat is that despite the value of 3WM questions some students struggle with a novel question format and with what appears to be cognitive overload. The card sorting approach has addressed the unfamiliarity issue and provides a unique hands-on opportunity for students to practice, with feedback. The exercise has also dramatically changed the dynamic of our labs. We've since incorporated other related methods that get students working together using active, problem-solving approaches with clinical relevance. The mistake from which I hope I have learned, is to not pre-design in an assessment strategy that would provide less subjective measures of outcome. I have a better appreciation now of how that oversight is a problem, especially when it comes to dissemination.

9. Dissemination: If applicable, describe how your efforts have been recognized by others externally through peer review, dissemination, use by others, or teaching awards nationally.

Although I have shared the approach with others and it has been applied at our WSU regional campus in Logan, Utah, it has not been formally disseminated. This is something we should do, although we should have also designed a more quantitative assessment and gathered more objective outcome data.

Commented [SAH1]: Regarding student satisfaction, were students specifically queried regarding their perceived effectiveness of the exercise, or were these comments gleaned from the overall course evaluations? If the latter, how many students specifically commented on the exercise. This submission would be strengthened with more specific data.

Commented [SAH2]: Although most instructors seldom use assessment data to document learning outcomes for teaching interventions, such data would significantly strengthen the anecdotal report of effectiveness here.

Commented [SAH3]: Good. See previous comment.