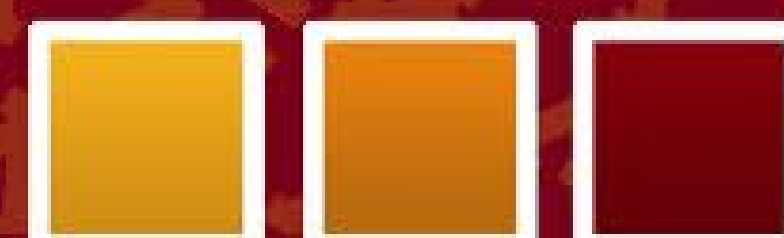


Scenario Based Learning (SaBLE) for Urinalysis Identification and Quantification

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Abstract

The medical laboratory sciences curriculum at the University of Minnesota – Twin Cities was structured to help students prepare for their future profession. As part of the medical laboratory sciences curriculum, students were required to demonstrate proficiency in performing a microscopic examination for urinalysis. This required students to learn how to identify and quantify normal and abnormal components found in urine. While practicing these skills, students experienced limitations in the amount and type of feedback they received based on the limited amount of time in lab practice (2.5 hours per week) and the variations in instructor feedback. The urinalysis Scenario Based Learning (SaBLE) online e-module was created as a supplementary educational intervention to improve medical laboratory sciences student experience and performance in the urinalysis section of the Body Fluids course. Previous studies, such as the article written by Venkatesan. et. al, have shown that e-modules are effective learning tools when used to supplement course content. The module was designed to have pre- and post- student surveys as well as two core modules that guided students through identification and quantification in urinalysis. The module will be implemented in the Spring 2025 semester at the University of Minnesota – Twin Cities. After the Spring 2025 semester, the effectiveness of the urinalysis SaBLE module and student perceptions will be assessed by analyzing exported SaBLE data as well as comparing pre- and post-exam scores for improvements.

Background

Educators are always looking for ways to improve students' learning outcomes and engagement. This is especially applicable in the health education where information changes rapidly. With the shifts in information, new tools can be developed to adapt to these changes. The SaBLE modules were designed to incorporate both cognitive load theory and self-regulation theory. By incorporating both theories, instructors can facilitate better learning outcomes and better student learning retention.

Cognitivism describes learning as a process that involves thinking, memory, and reflection. The aim of cognitivism is to make new knowledge more meaningful to the learner, so that connections can easily be formed between new knowledge and prior knowledge. The goal of learning is to store information, otherwise the learner has not gained new knowledge.

Under the framework of cognitivism, is the cognitive load theory. This theory suggests that the working memory has a limited processing capacity, and it can only process 2-4 elements at a time for about 20 seconds. Through practice or rehearsal, working memory is more likely to be encoded into long-term memory. Unlike working memory, the storage capacity of long-term memory is limitless. For a self-directed learner, the goal of instructional design is to keep the cognitive load low. If there is too much information presented at once, this results in a high extraneous load. Therefore, the learner must use more working memory. To prevent high extraneous loads, the information in the instructional design should be presented in small chunks.

Another theory under cognitivism is the self-regulation theory. This theory helps to develop metacognition, strategic action, and motivation in students. Learners are more willing to attempt challenges, use different learning strategies, and are more aware of their learning strengths and weaknesses. Instructors can support this theory by providing self-paced learning, providing feedback mechanisms, and incorporate interactive elements. All of these are incorporated in e-modules. With e-modules, individuals can set goals, monitor their progression, and adjust their learning strategies.

In prior studies, e-learning modules have been shown to be equally as effective as a traditional lecture and are used best as a reinforcement tool rather than a replacement for lectures. Students have also reported benefits to using e-modules. The modules help to promote schedule flexibility, facilitate self-directed learning, and help to provide timely feedback.

Methods

One urinalysis SaBLE module was created for this project. The module was divided into 4 different levels. The first and fourth levels were designed for students to fill out the pre- and post surveys. The second level reviewed urinalysis components such as cells and crystals along with having students practice identification. The third level included explanations on how to quantify the different components in urinalysis and included practice questions to help the student practice quantifying. Following cognitive load theory, the second and third levels presented information in small segments to decrease extraneous load. To promote self-regulation theory, feedback was given if students answered a question incorrectly so that they could reassess and reflect on their learning. Both levels included still elements such as text and photos. The levels also included interactive elements such as multiple-choice questions, true/false questions, and free text questions.

Table 1. Pre- and Post- Module Student Survey Questions

Pre-Survey Questions	Have you reviewed the urine crystals and urinary cell lectures for class?
	To what degree do you agree or disagree with the following statement? Likert Scale 1-10, 1= strongly disagree, 10 = strongly agree <ul style="list-style-type: none">I feel confident identifying the urinalysis components without help from an instructor.I feel somewhat confident identifying urinalysis components.I'm worried I will not be able to identify any of the components.
	Please rate your confidence level identifying urinalysis components. 1 meaning you feel the least confident. 10 meaning you feel the most confident.
	Have you reviewed the urinalysis quantification for class?
	To what degree do you agree or disagree with the following statement? Likert Scale 1-10, 1= strongly disagree, 10 = strongly agree <ul style="list-style-type: none">I feel confident quantifying the urinalysis components without help from an instructor.I feel somewhat confident quantifying urinalysis components.I'm worried I will not be able to quantify any of the components.
	Please rate your confidence level quantifying urinalysis components. 1 meaning you feel the least confident. 10 meaning you feel the most confident.
Post Survey Questions	Please describe your experience using SaBLE for identifying urinalysis components.
	Please describe your experience using SaBLE for quantifying urinalysis components.
	Same questions as pre-survey.
	Do you feel that the SaBLE module helped you prepare for your laboratory classroom session?
	Do you feel that the SaBLE modules were a good time investment for learning identification and quantification?

Figure 1. Screenshot of a multiple-choice question from the urinalysis identification level.

Scenario Based Learning Environment Overview

Let's see what you remember. What is this?

Transitional Epithelial
 Renal Epithelial
 White Blood Cell
 Squamous Epithelial

Check My Answer

Hooray! You got it! Squamous epithelial cells are large and irregularly shaped. They have a nucleus in the center of the cell with a high amount of cytoplasm.

Prev Next

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Discussion

For every medical laboratory science student, performing a microscopic examination of urine is an important skill. Initially, students often struggle to learn how to identify and quantify the different urinalysis components. During class, students can ask questions and receive immediate feedback while developing their skills. However, students face barriers such as limited laboratory time and student feedback can also vary depending on the questions asked and components seen in the laboratory. The urinalysis SaBLE module was created as a self-paced, supplementary tool in addition to traditional lecture and laboratory class times. The tool was intended to help students solidify their understanding of identification and quantification of urinalysis components in a low stakes and low stress environment. The project is limited in the fact that it was not constructed based on student feedback, but it was developed based on what the educator thought were important concepts for students to learn.

The modules included pre- and post-surveys that will be used for qualitative analysis. Pre-survey results will be compared to the post-survey results. Student feedback will also be analyzed to assess the effectiveness of the modules and to assess student satisfaction. Confidence level questions will also be examined based on the Likert scale. Additionally, the number of correct exam questions related to the SaBLE module will also be assessed to see if the SaBLE module was an effective learning tool. Exam results will be compared between classes that have used the urinalysis SaBLE module to previous classes that did not utilize the urinalysis SaBLE module.

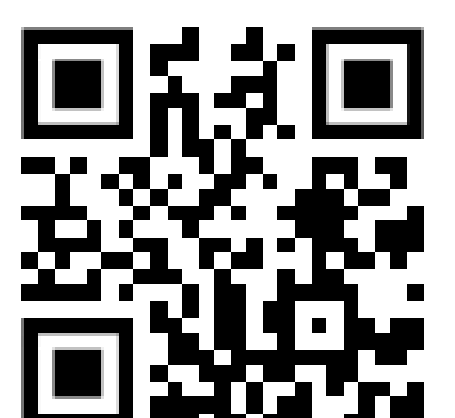
Conclusion

The urinalysis SaBLE module was created as a self-paced learning tool to aid students in the Body Fluids course. The expected outcomes were to increase student learning retention and increase student confidence with recognizing and quantifying abnormal and normal urinalysis components. The urinalysis SaBLE module will be implemented in the Spring 2025 semester. Pre- and post-survey results will be exported from the SaBLE module post Spring 2025 and analyzed for similar themes and patterns. Additionally, exam results will be compared from previous semesters without urinalysis SaBLE utilization to semesters where the students had utilized the urinalysis SaBLE module. For the future, student feedback should be used to make improvements to the module. As a suggestion, additional features such as sounds and videos could be implemented to add more types of multimedia to SaBLE.

QR Code References:



Using this QR code or navigating to www.sable.umn.edu, register for an account and enter these Registration Codes:



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