Design and Testing of an Interactive Module for Improving Understanding and Application of Institutional Antibiograms

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ABSTRACT

Background
Many treatment guidelines recommend incorporating local antibiograms (ABs) into treatment decisionmaking. However, studies suggest many healthcare provider trainees are uncomfortable using ABs and rarely incorporate them into their decisionmaking. Our purpose was to develop a brief online module to develop skills in locating and utilizing an institutional AB and to gather feedback on its utility.

Methods
We developed and tested the module at the University of California San Francisco, with initial testing among 340 pharmacy students during microbiology instruction. We used the Four-Component Instructional Design framework to inform our design approach. Using the Articulate Storyline platform, we developed an interactive online learning module. The module began with a patient case to introduce the whole task and activate prior knowledge, with learners required to enter a freetext answer to the case prompt. Using visuals and narrated text, the module then reviewed the basics of an AB, how to use an AB for targeted therapy with known pathogens and for empiric therapy, and for location-specific and combination ABs. Task practice was provided by case-based questions requiring learner response and providing immediate feedback. The module ended with a competency assessment including revisiting the original case and reviewing the initial answer. Learners completing the module were directed to complete a survey to provide feedback on the module; we report quantitative and qualitative feedback from the survey.

Results
We received 131 survey responses (38.5%). 111/131 (85%) rated the educational value of the module as "Extremely valuable", and 103/131 (79%) rated the module as having "Excellent usability". Primary themes among positive feedback included the interactive elements, stepwise approach, and questions with feedback; constructive feedback included desire for speed control of the narration and sound quality.

Conclusion
An interactive online module for learning about ABs was highly rated by learners and may be valuable to help clinicians use ABs in practice. Future studies should include other health professions learners, delayed assessment to measure retention, and customization for different institutional ABs.

BACKGROUND

-**Antibiograms (ABs)** are aggregated reports of institutional antimicrobial susceptibility tests
-Many guidelines recommend **incorporating AB data into treatment decisionmaking**
-Only **12% of medical residents reported using insitutional ABs** for selection of antibiotic treatment[1]
-**Half or less of students** in medicine (34%)[2] and pharmacy (52%)[3] feel they received **good education** around using antibiograms
-**Online learning modules** (though often hated) can be an **effective and efficient** method of education with **proper design**

METHODS

-Developed online modules at University of California San Francisco
-**Initial testing** among cohort of 340 **pharmacy students** during microbiology instruction over three instructional years
-Used **Articulate Storyline** platform (www.articulate.com) to design **interactive architecture**
-Informed by **Four-Component Instructional Design** (4C/ID) learning framework (Figure 1)[4]
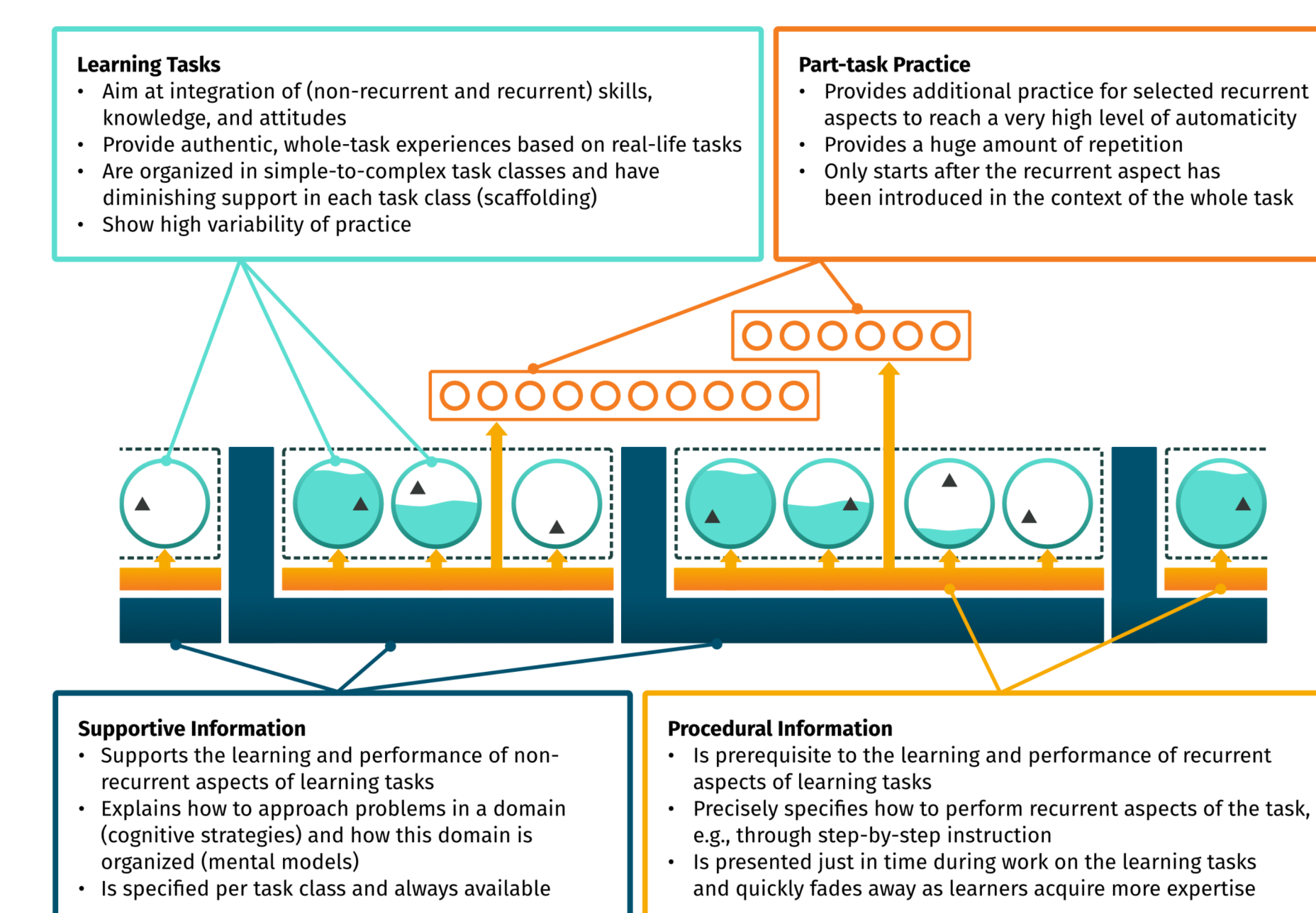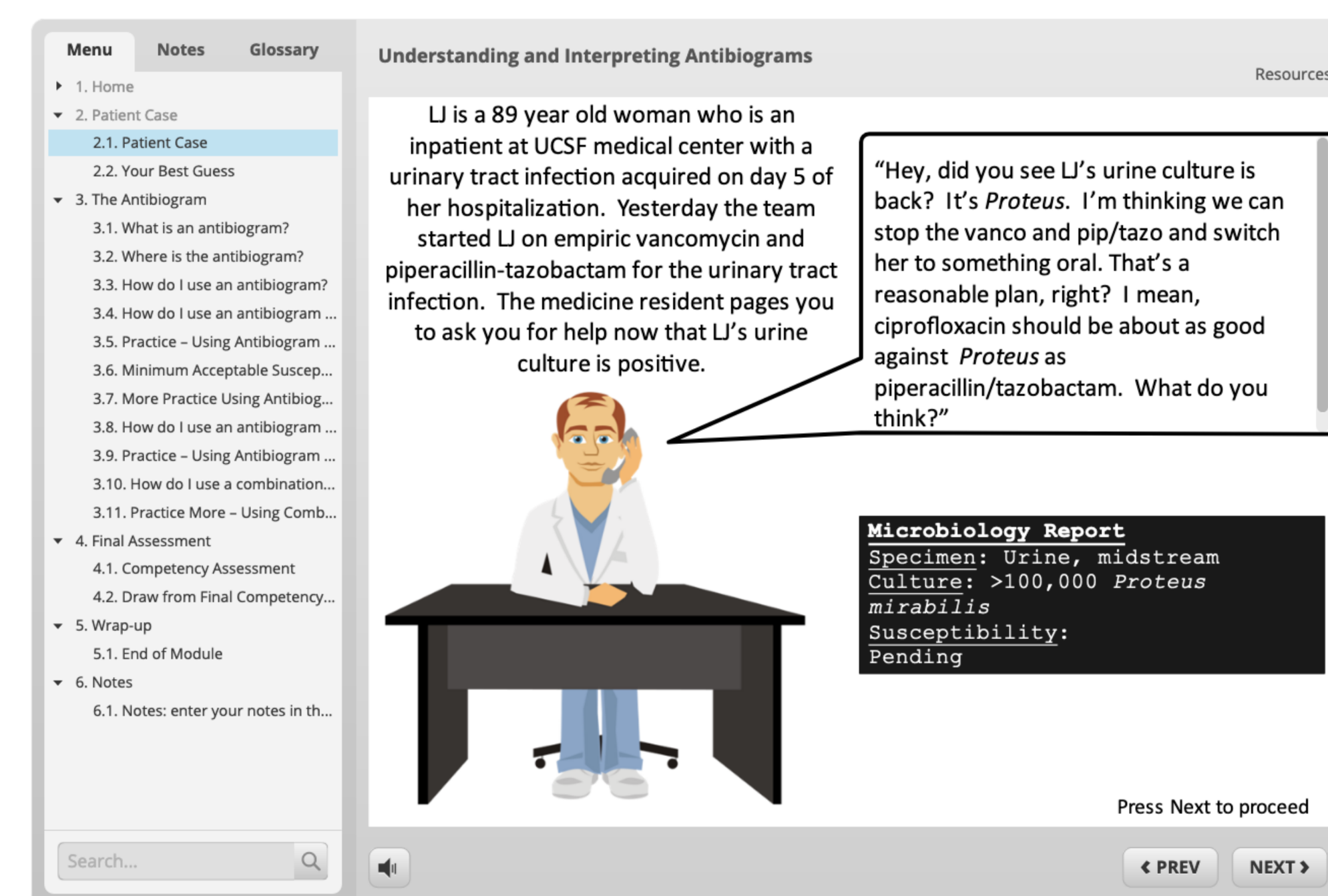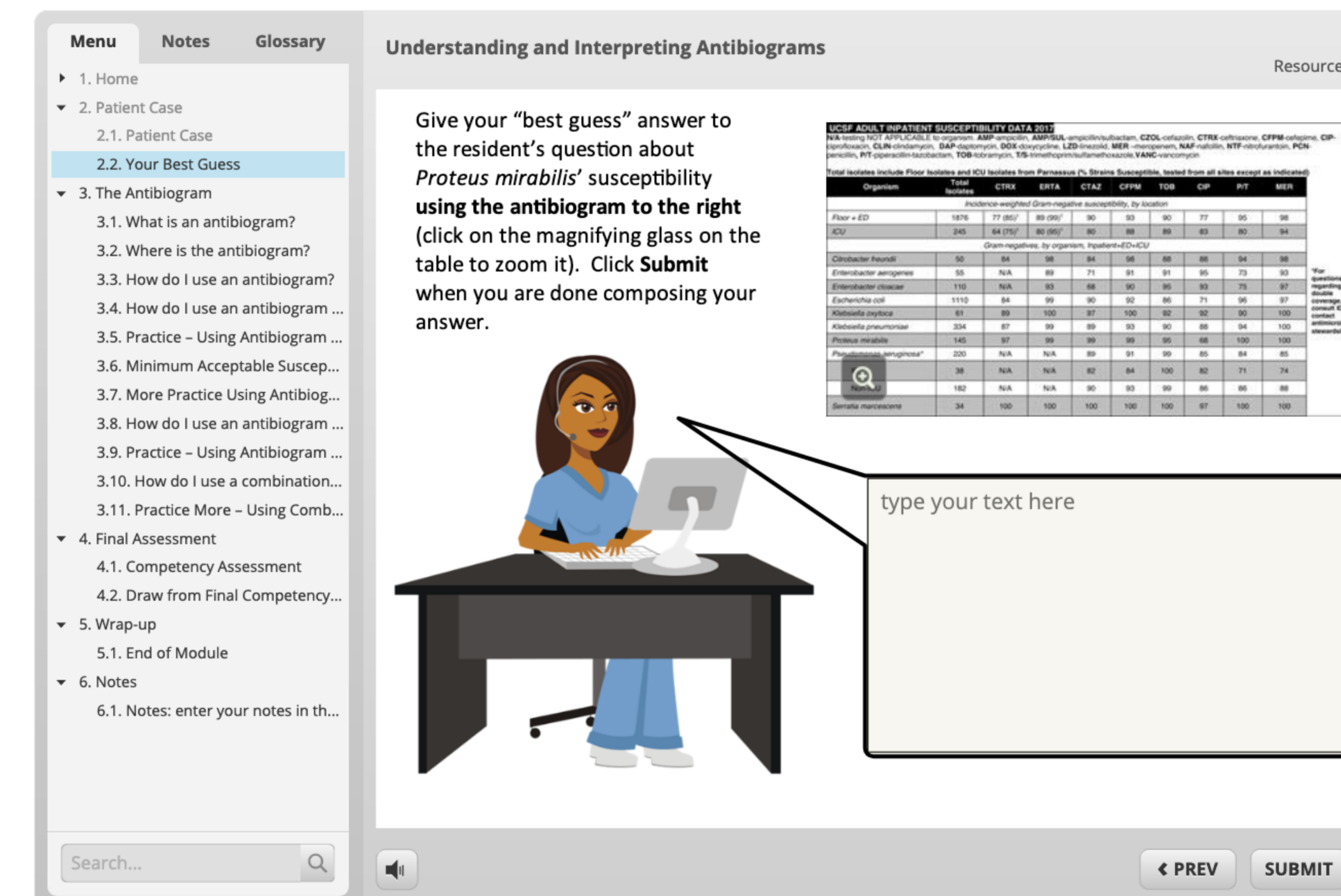-Gathered feedback via optional **end-of-module survey**

Figure 1: Four-Component Instructional Design (4C/ID) schematic (https://www.4cid.org/)

We designed an interactive online module on antibiograms providing stepwise instruction, clinical applications, and competency assessment
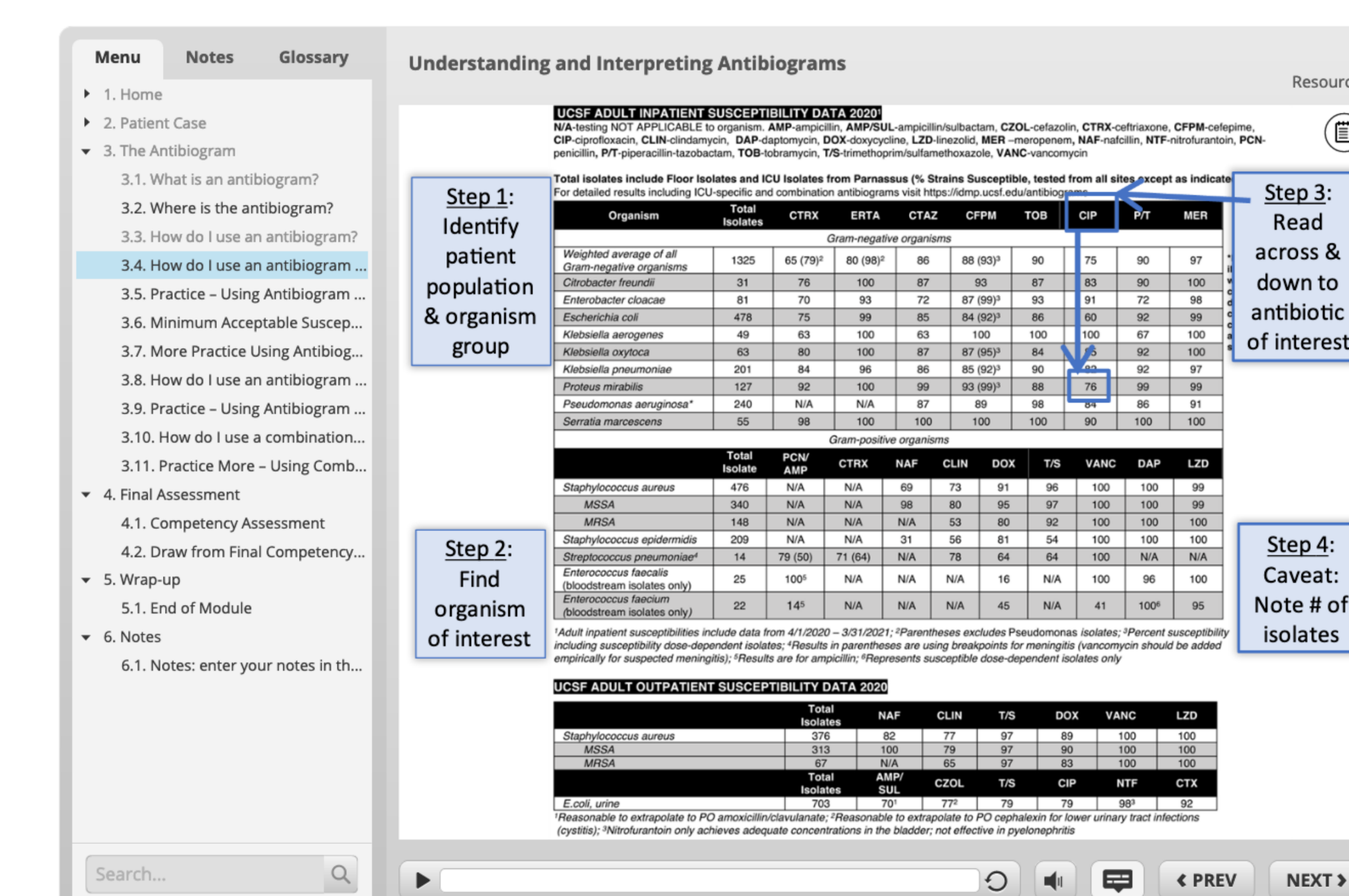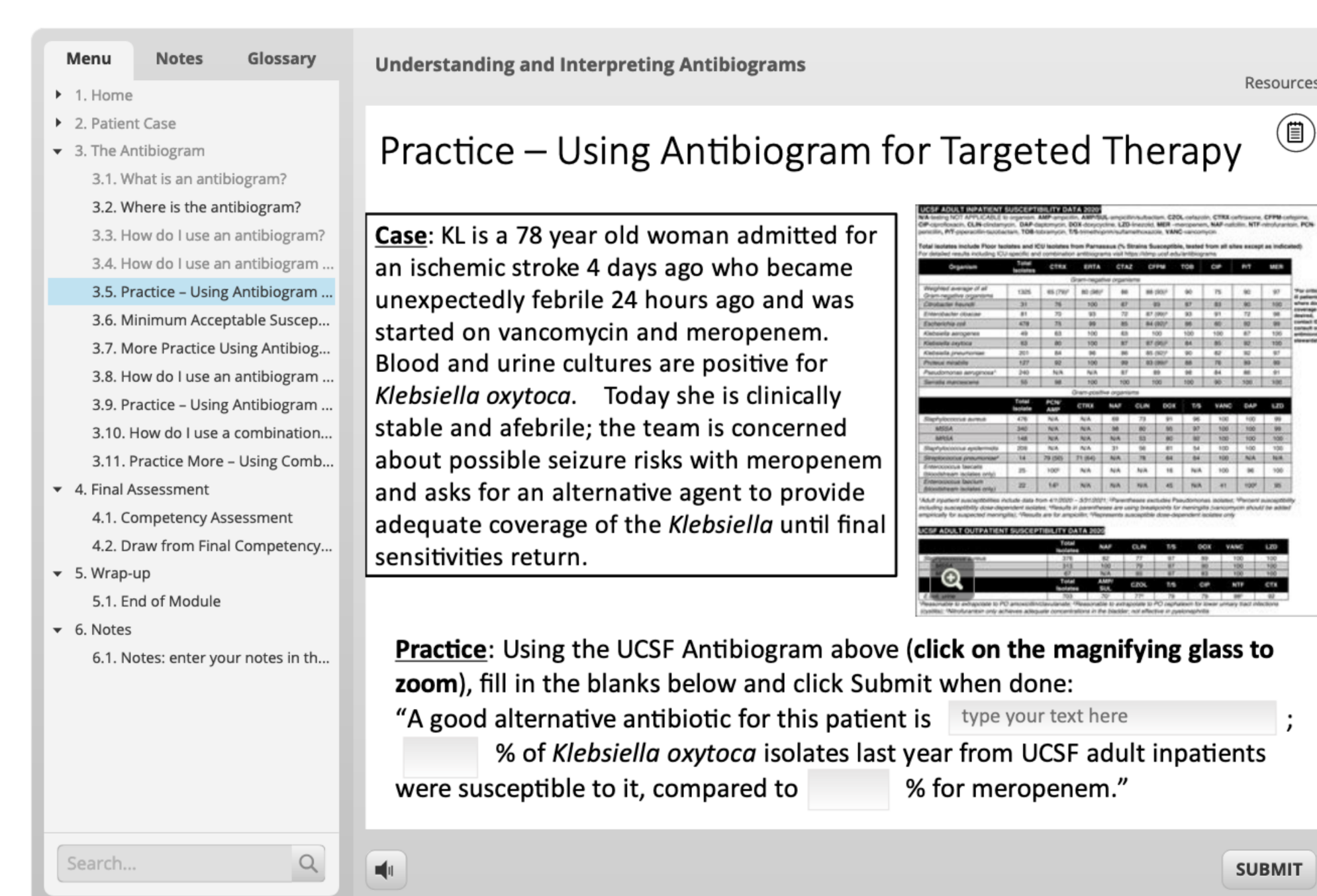
Introductory Framing Case

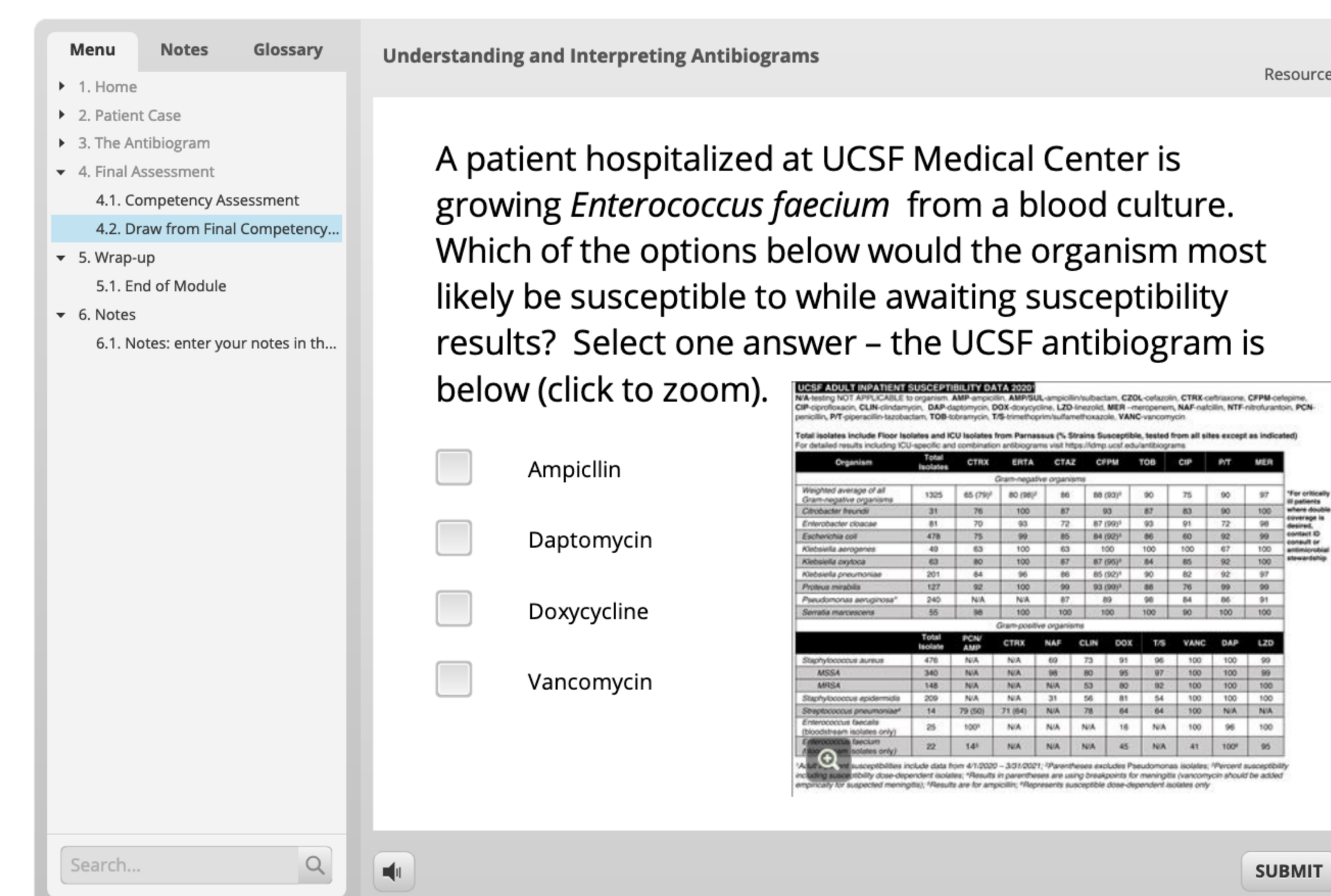### Activating Prior Knowledge

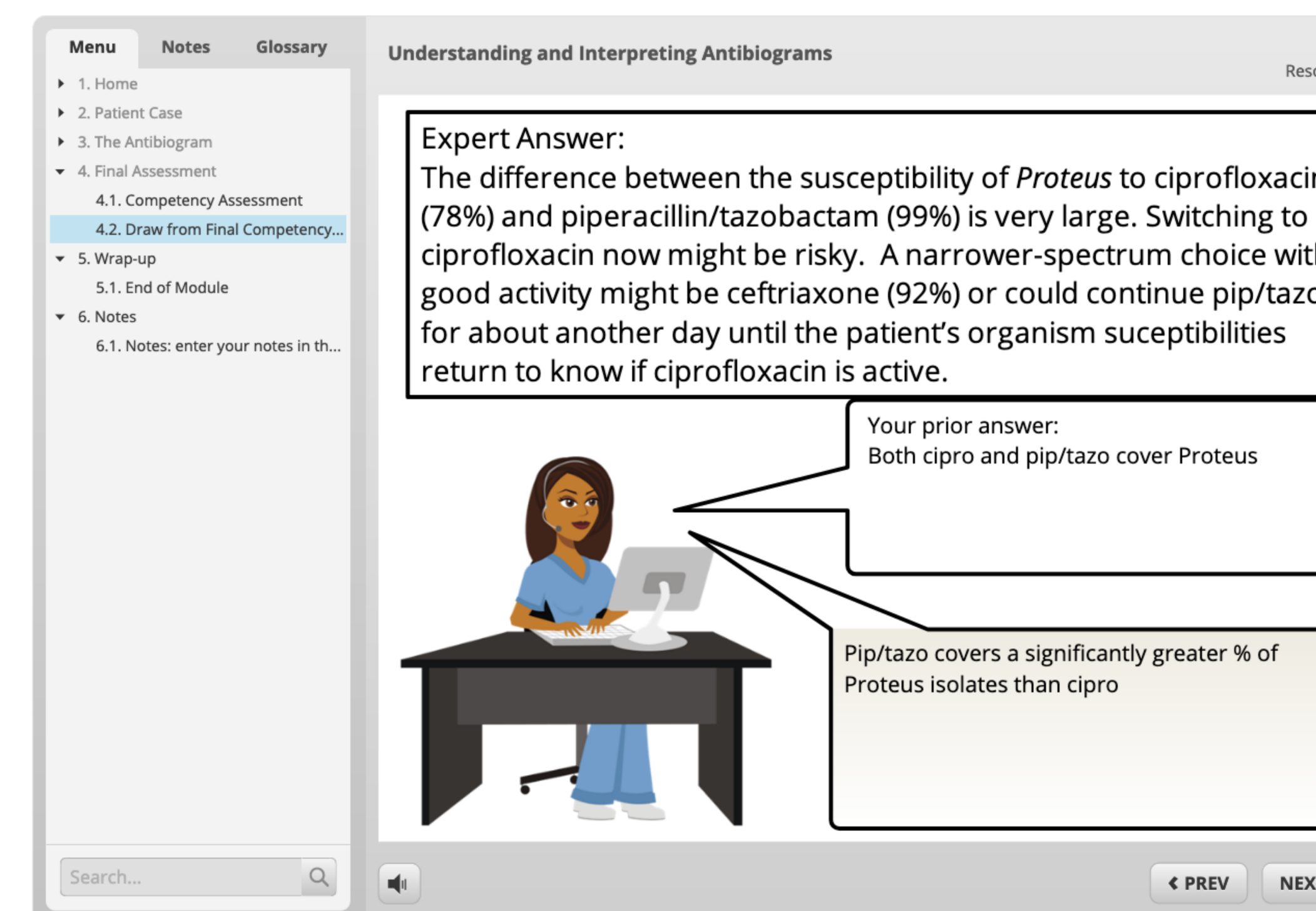### Step-By-Step Tutorial

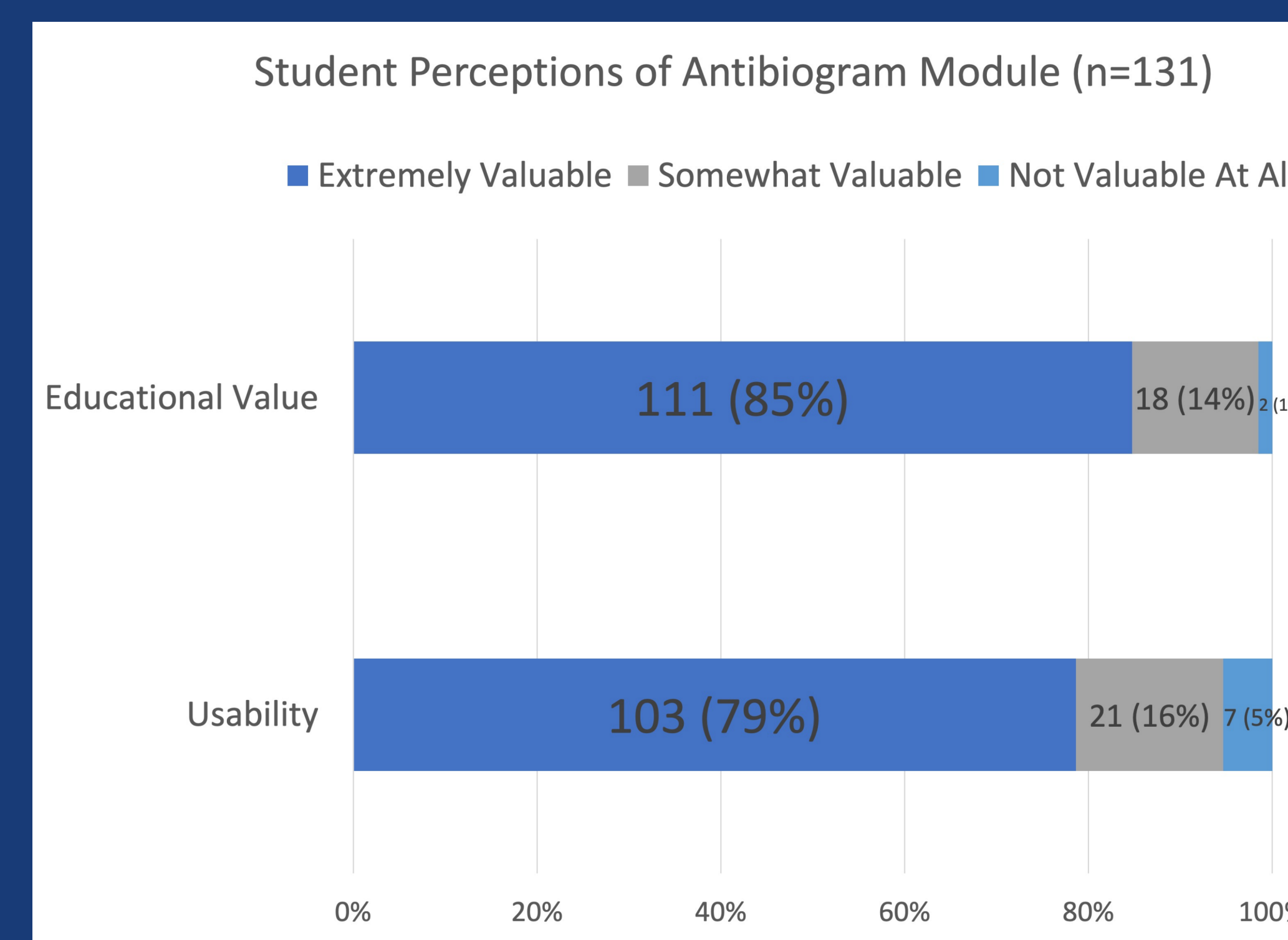### Scaffolded Practice Exercises

Competency Assessment

Compare Initial/Final Answers with Expert

Students rated of the educational value and usability of the module highly

Reinforcing Feedback Themes
✓ Interactive elements
✓ Stepwise learning approach
✓ Embedded questions with feedback

Improvement Feedback Themes
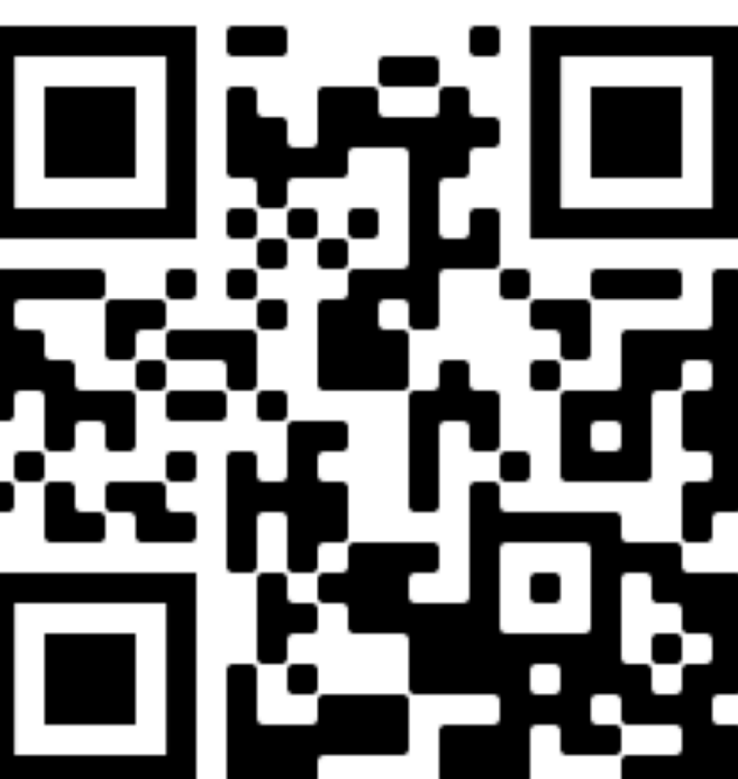⊖ Inability to control narration speed
⊖ Sound quality/clarity

LIMITATIONS
-**Single-center**, single-profession, single training level
-Voluntary feedback, **risk for nonresponse bias** (39% response rate)
-Module **completion time** not tracked (estimated ~10 minutes)
-**Retention of knowledge** not assessed

FUTURE DIRECTIONS
-**Expansion of test user populations** to determine fit for medical trainees and pharmacy residents/practitioners
-**Delayed follow-up assessments** to measure retention of knowledge and skills
-Ability to **customize content to different institutions** (e.g. antibiogram location, antibiogram apperance)

-This module and other interactive modules are **freely available online** as part of the ATLAS (Asynchronous Tools for Learning AntimicrobialS) project: https://tiny.ucsf.edu/atlas
-Users with ability to edit Articulate Storyline documents can request source files to customize for local use

REFERENCES

[1]Tallman GB, et al. Empiric antibiotic prescribing decisions among medical residents: the role of the antibiogram. Infect Control Hosp Epi 2018;39:578-583
[2]Abbo LM, et al. Medical students' perceptions and knowledge about antimicrobial stewardship: how are we educating our future prescribers? Clin Infect Dis 2013;57:631-638
[3]Justo JA, et al. Knowledge and attitudes of doctor of pharmacy students regarding the appropriate use of antimicrobials. Clin Infect Dis 2014;59(S3):S162-169
[4]Vandewaeter M, et al. 4C/ID in medical education: how to design an educational program based on whole-task learning: AMEE guide No. 93. Med Teacher 2015;37:4-20

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