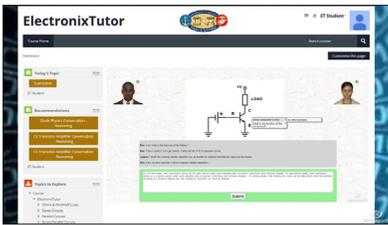




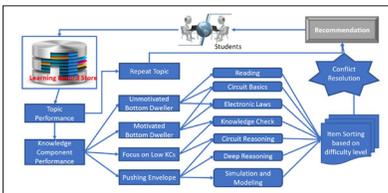
INTEGRATION OF INTELLIGENT TUTORING SYSTEMS FOR ELECTRONICS (ElectronixTutor)

Supplementing the existing instructor-led training with advanced learning environments.



User Interface

ElectronixTutor is an Intelligent Tutoring System (ITS) focusing on Navy Apprentice Technician Training courses in basic electricity and electronics. The goal of this effort is to supplement the existing instructor-led training with advanced learning environments (ITS and other adaptive learning technologies) that sailors can complete at their own pace.



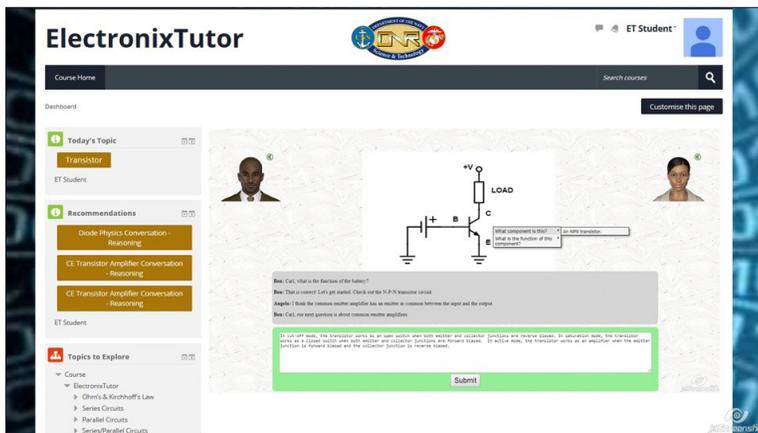
Recommender System

Using ElectronixTutor, sailors will be able to access selected readings from their Naval A-School curriculum, converse with their tutor (a computer agent) in natural language, engage in deep-reasoning question-answering with their tutor, answer multiple-choice questions, explore and construct mental models of circuits in a simulation environment, and interact with figures through a Point and Query facility to find answers to common questions. Data from the experience of each sailor is recorded in the student model, so that intelligent recommendations can be made to focus a sailor's attention on the knowledge components where they need additional practice and in the mode in which they need to continue their training.

Sailors will be able to access selected readings from their Naval A-School curriculum and converse with their tutor in natural language.

RESEARCH CHALLENGES AND OPPORTUNITIES

- Helping sailors learn with the latest advances in learning technologies on the web.
- Tracking the knowledge, emotions, and psychological characteristics of the individual sailor and their impacts on learning.
- Recommending the *right* learning resource on the *right* topic at the *right* time for an individual sailor.
- Summarizing performance of sailors and presenting results to the individuals and their instructors.
- Improving learning, retention, and transfer of training by applying principles of cognitive science, data mining, and learning analytics.



USER INTERFACE

The interface is designed to give sailors access to the content in multiple ways with Moodle as the exemplar Learning Management System. Sailors can engage with tutor-guided questions presented as the topic of the day and managed by a calendar system that matches the syllabus for the class. For additional practice, the sailor can self-select either by choosing a problem recommended based on the system's current assessment of their learning, or by choosing a problem from the tree-structure list of course topics. Sailors are also able to see their progress, mastery levels for each topic, and full course calendar.

Sailors have access to multiple learning resources within the ElectronixTutor environment. These include:

AutoTutor (pictured above): Conversational agents that promote verbal reasoning, question answering, conceptual understanding, and natural language interaction.

Point and Query: Interactive diagrams that help sailors visually identify key components of complex circuits and understand their functions.

Dragoon: A simulation environment that allows sailors to visualize how any change in a circuit element has potential repercussions on other elements and the circuit as a whole.

ASSISTments: A platform for building learning technologies and assessment materials delivered on the web.

LearnForm: Problem-solving learning activities with an in-depth, multi-step solution breakdown including hints and feedback.

BEETLE-II: Remedial resource presenting simpler circuit problems to help sailors reacclimate to topics they may not have seen recently.

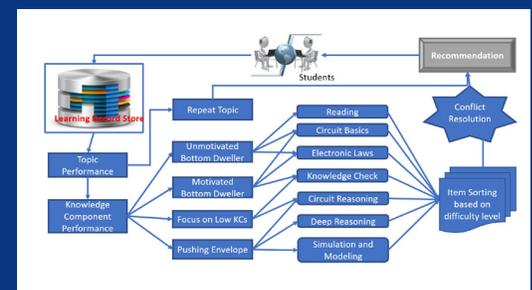
NEETS: Navy Electricity and Electronics Training System documentation to ensure sailors have access to the exact material most relevant to their professional assessment.

Taken together these resources provide a unique learning environment, allowing the sailor to tackle difficult concepts through an array of pedagogically rigorous approaches.

STUDENT MODEL AND RECOMMENDER

ElectronixTutor collects performance measures on each instructional module, such as time on task, percent correct, the match between scores for trainee behavior and expectations, and mastery of knowledge components associated with each topic. These performance measures are stored in a data repository that updates the student model. An intelligent recommender system uses this data to decide which learning module and knowledge components should be recommended to the learner for additional practice. The student model profile of the sailor informs these decisions as follows:

- 1) Session features are extracted from the Learning Record Store (xAPI, TLA, and GIFT).
- 2) Student mastery on Knowledge Components is estimated and resources organized to maximize learning.
- 3) Resources are reweighted to match active topics opened by sailors as well as the course curriculum.



Recommender System