

Designing Interactive and Personalized Concept Mapping Learning Environments

Shang Wang

School of Computing, Informatics, and Decision Systems Engineering, Arizona State University, USA

Overall Research Goals

How does personalized scaffolding facilitate learning with concept maps?

How does hyperlinking enhance student navigation and support learning?

How do we design an interactive and personalized concept mapping environment to support meaningful learning?

Approach

We developed an iPad-based digital textbook integrated with a concept mapping tool. Students can construct concept maps directly from the textbook and use the hyperlinking feature for navigation.

The major sources of water pollution are agriculture, industries, and mining. Agricultural activities are by far the leading cause of water pollution. Sediment eroded from agricultural lands is the largest source. Other major agricultural pollutants include fertilizers and pesticides, bacteria from livestock, and excess salt from soils of irrigated lands. **Industrial facilities** are another source of harmful inorganic and organic chemicals. Mining is a third source. Surface mining disturbs the earth's surface, creating a major source of sediment and runoff of toxic chemicals. **Climate change** is a global warming can also affect water pollution. In a warmer world, some areas will get more precipitation and other areas will get less. Intense downpours can flush more harmful chemicals, plant nutrients, and microorganisms into waterways. Prolonged drought can reduce river flows that dilute wastes and spread infectious diseases more rapidly among people who lack enough water to stay clear.

Major Water Pollutants and

Water is polluted by disease-causing agents, oxygen-demanding wastes, plant nutrients, organic and inorganic chemicals, sediment, and excess heat.

Two major water pollution problems are exposure to infectious disease organisms (pathogens) from having to drink contaminated water and not having enough water for effective sanitation.

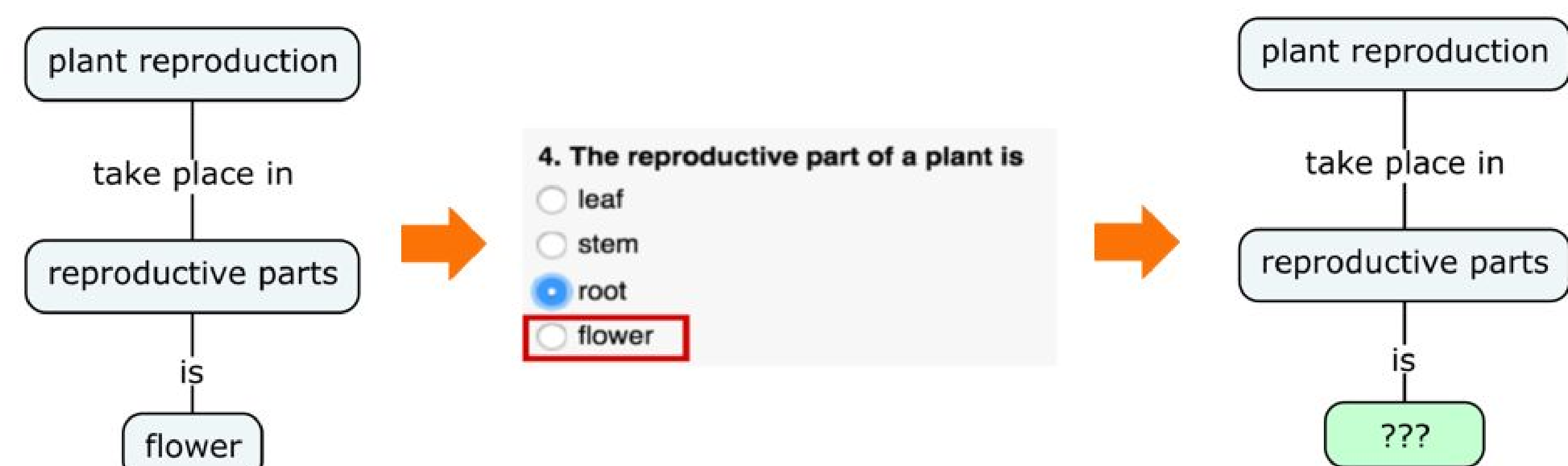
2/5

Concepts for a given page are highlighted

Long click to add a concept node

Personalized Scaffolding

To support the process of integrating new knowledge to existing knowledge structure, we present students with incomplete templates with the unlearned concepts (incorrect in the pre test) left blank for students to fill in.



Hyperlinking Navigation

Hyperlinking navigation offers flexibility in comparing concepts located in different pages, developing personalized navigational path and other learning behaviors.

Ongoing Studies

We are currently running an Amazon Mechanical Turk study and a high school study to evaluate the system.

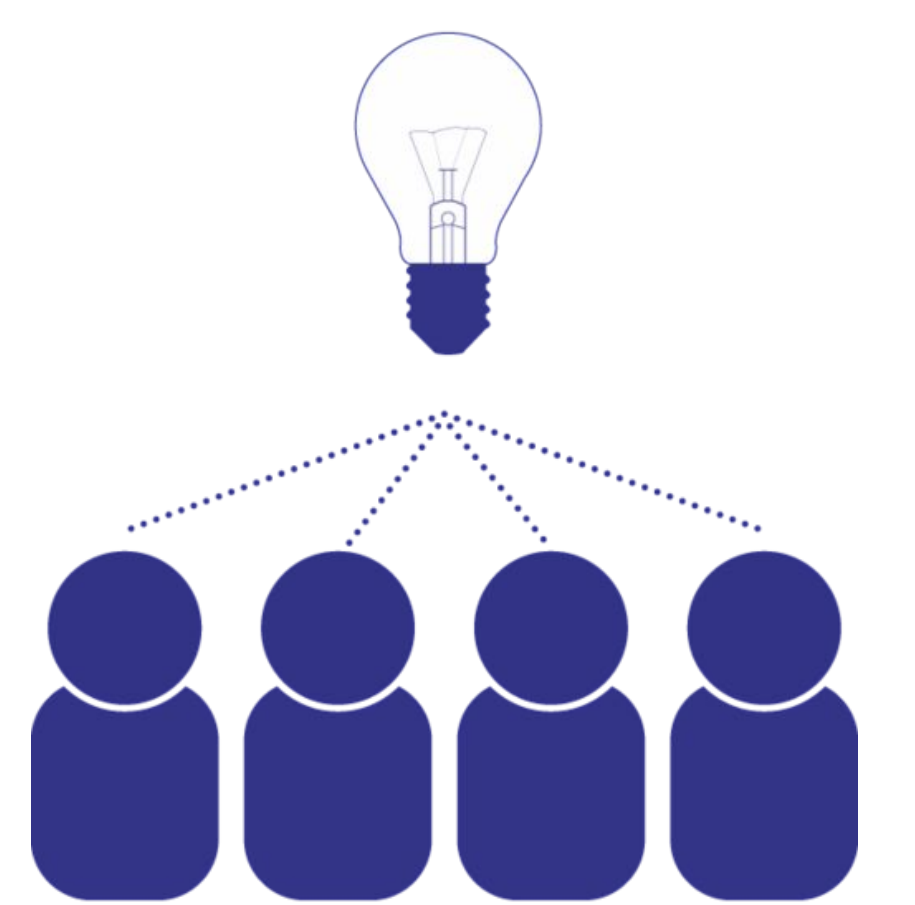
Amazon Mechanical Turk Study

Participants: Amazon Mechanical Turkers.

Period: 30 minutes.

Conditions: Students will be presented with randomized incomplete templates.

Goal: Evaluate how different designs of templates affect student learning.



High School Study

Participants: High school seniors.

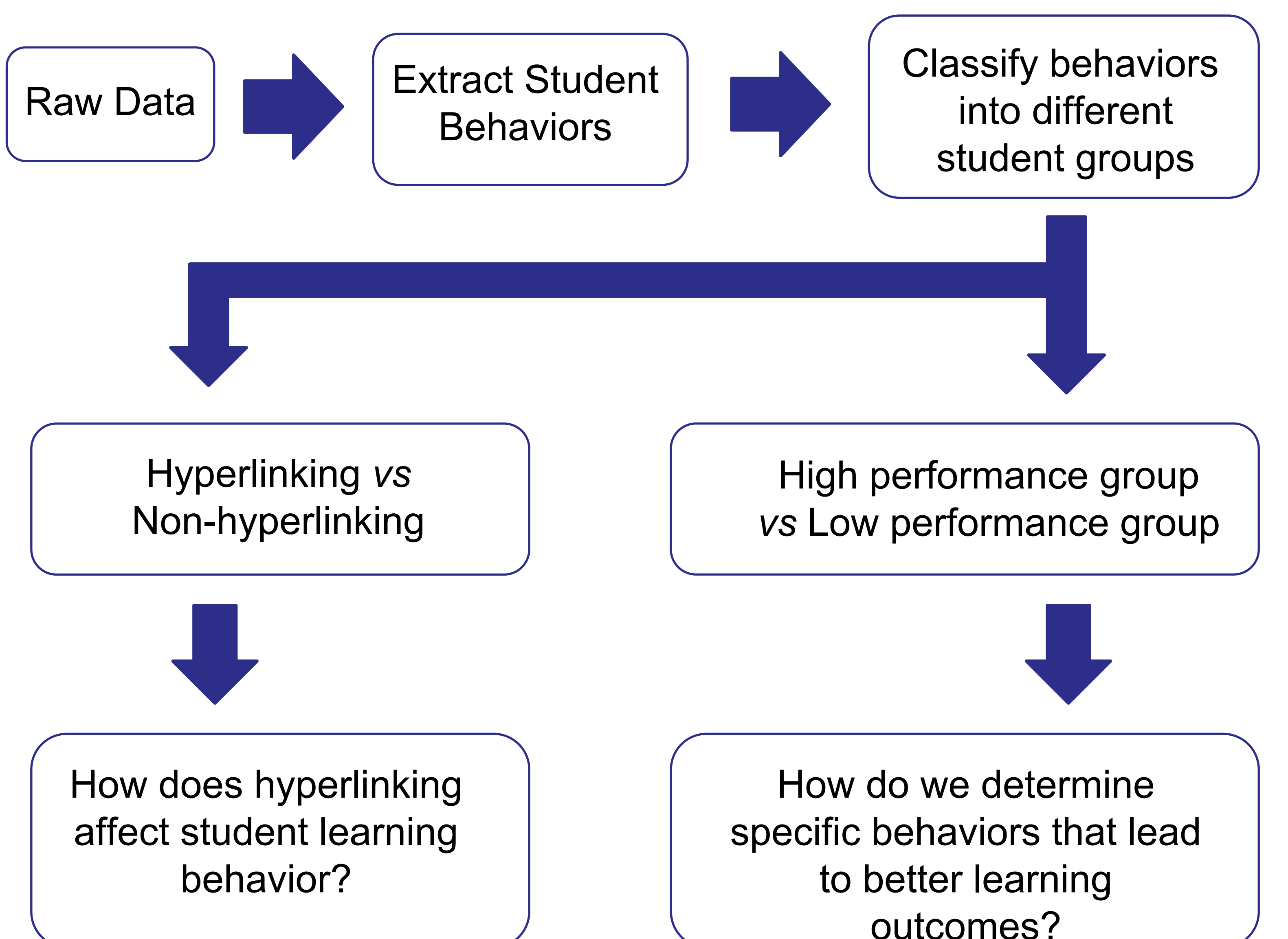
Period: 20 minutes per day for 5 days.

Conditions: A hyperlinking condition and a non-hyperlinking condition.

Goal: Examine how hyperlinking affects student navigation.



Analysis



Open Questions

- Amazon Mechanical Turk participants are very different from high school students. How should I validate the Amazon Mechanical Turk study results?
- What data mining techniques can be used to determine how hyperlinking feature affects student navigation and what learning behaviors would yield better learning outcomes?