



Learning and Knowledge Growth

Learning Models & Adaptive Tools

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Overview

1. Key aspects for learning and knowledge growth in online education
 - Activity 1: What We Are Learning From Online Education (Koller, 2012)
 - Activity 2: The 2 Sigma Problem: The Search For Methods Of Group Instruction As Effective As One-To-One Tutoring (Bloom, 1982)
2. Open Learner Models: Concepts & uses to inform on learning & knowledge growth
3. Adaptive learning: Concepts & applications
 - Activity 3: Adaptive Learning (Kerr, 2016)
4. Adaptive Learning Tools
 - Activity 4: Tool Review, Comparison, & Discussion



Key aspects for learning and knowledge growth in online education



Activity 1: What We Are Learning From Online Education, Koller (2012)

Activity 1: What We Are Learning From Online Education, Koller (2012)



Activity 1: What We Are Learning From Online Education, Daphne Koller

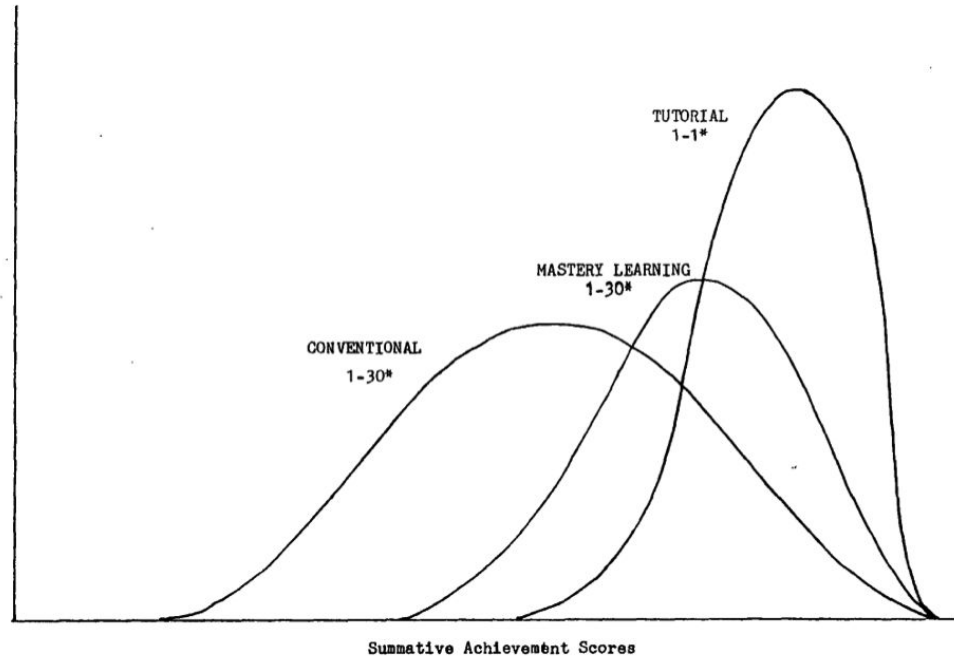
1. Why is online education important or relevant for enhancing learning and knowledge growth?
2. When trying to promote learning and knowledge growth using online tool, what aspect should you consider in order to make your tool successful?
3. What analytics need to be included and/or would be helpful in tracking and encouraging learning and knowledge growth?





Activity 2: The 2 Sigma Problem, Bloom (1982)

Activity 2: The 2 Sigma Problem: The Search For Methods Of Group Instruction As Effective As One-To-One Tutoring, Bloom (1982)



*Teacher-student ratio

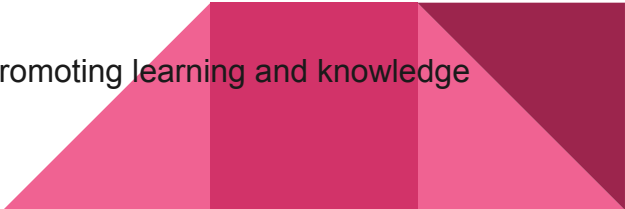


Activity 2: The 2 Sigma Problem: The Search For Methods Of Group Instruction As Effective As One-To-One Tutoring, Benjamin Bloom

1. How important would tutoring be when thinking about creating an online tools for promoting learning and knowledge growth?
2. How would you achieve tutoring if you were asked to create an online tool for promoting learning and knowledge growth?



Summary Activity 1 and 2

- Why is online education important or relevant for enhancing learning and knowledge growth?
Access to education - Reach more people - Global communities
 - When trying to promote learning and knowledge growth using online tools, what aspect should you consider in order to make your tool successful?
Personalization - Retrieval practice - Tutoring- Igniting minds - Interaction with materials - Self grading - Peer revision - Peer grading - Immediate feedback
 - What analytics need to be included and/or would be helpful in tracking and encouraging learning and knowledge growth?
Dashboards - Tree of Knowledge
 - How important would tutoring be when thinking about creating an online tools for promoting learning and knowledge growth?
Very important
 - How would you achieve tutoring if you were asked to create an online tool for promoting learning and knowledge growth?
Brainstorming
- 

Open Learner Models

Learner (or Student) Model

It is a model constructed from observation of interaction between a learner and a learning system or instructional environment.

“The learner model is a model of the knowledge, difficulties and misconceptions of the individual. As a student learns the target material, the data in the learner model about their understanding is updated to reflect their current beliefs”

Bull, S., Kay, J.: Student Models that Invite the Learner In: The SMILI Open Learner Modelling Framework. International Journal of Artificial Intelligence in Education 17(2), 89-120 (2007)

Open Learner Model

Open learner models are learner models that can be viewed or accessed in some way by the learner, or by other users (e.g. teachers, peers, parents).

Susan Bull and Judy Kay. (2010). Chapter 15. Open Learner Models. Electronic, Electrical and Computer Engineering, University of Birmingham,. B15 2TT, UK.



Open Learner Model Tool, an example

The interface includes a toolbar with icons for different visualization types. Below the toolbar are tabs for 'Mapping', 'Feedback', 'Task List', and 'Achievements'. The 'Achievements' tab is active, showing a 'Select a unit:' dropdown, a 'Select a task:' dropdown, and a list of Learning Outcomes (LO1, LO2, LO3) with their descriptions.

Displaying an individual student's achievement

LO1: Proficiently demonstrates communication in English, including listening, speaking, reading and writing.
 LO2: Uses critical thinking in making judgements and decisions.
 LO3: Executes tasks proficiently and on-time.

The tool displays several visualization options for the student's current achievements (LO1: 6.5, LO2: 7, LO3: 3.5):

- Bar graph:** A bar chart showing scores for LO1, LO2, and LO3.
- Skill meter:** A horizontal bar chart showing progress for LO1, LO2, and LO3.
- Target plot:** A target-like plot showing scores for LO1, LO2, and LO3.
- Grid plot:** A grid plot showing scores for LO1, LO2, and LO3.
- Spider plot:** A spider plot showing scores for LO1, LO2, and LO3.
- Tree map:** A tree map showing scores for LO1, LO2, and LO3.
- Smiley face:** A smiley face icon showing scores for LO1, LO2, and LO3.
- Word cloud:** A word cloud showing scores for LO1, LO2, and LO3.
- Table:** A table showing scores for LO1, LO2, and LO3.
- Pictogram:** A pictogram showing scores for LO1, LO2, and LO3.

Assume that a student's current achievements of learning outcomes: LO1, LO2 and LO3, are 6.5, 7, and 3.5 on a scale of 10.

Adaptive Learning

A woman with long dark hair is shown from the chest up, looking upwards and to the right with a thoughtful expression. The background is a dark, out-of-focus bokeh of light spots. The entire image has a blue color cast.

 1,049

The Fitbit of Education?

A blue-tinted photograph of students in a classroom. In the foreground, a student is looking at a laptop screen while another student points at it. The laptop screen displays a data visualization with a pie chart. In the background, other students are seated at desks with laptops. The text 'Intelligent Tutoring Systems (ITS's)' is overlaid in white on the image.

Intelligent Tutoring Systems (ITS's)



ITS's vs. Adaptive Learning



Activity 3: Adaptive Learning, Kerr (2016)

Definitions

Individualization

Learning goals are the same for all students, but students can progress through the material at different speeds.

Differentiation

Learning goals are the same for all students, but the method or approach of instruction varies according to the preferences of each student or what research has found works best for students like them.

Personalization

The learning objectives and content as well as the method and pace may all vary.

Types of Adaptive Learning

Facilitator Driven

vs.

Assessment Driven



Types of Models

Content Models

Learner Models

Instructional Models




Great...so how does this all go together?



Adaptive Learning:
Knewton





What if you don't have an explicit content model to work from?

The image features a dark, almost black background with several translucent, glowing blue cubes scattered across it. The cubes vary in size and are positioned at different angles, creating a sense of depth. The light from the cubes is soft and diffused, giving them a crystalline appearance. In the center of the image, the words "Machine Learning" are written in a clean, white, sans-serif font. The text is centered both horizontally and vertically, standing out prominently against the dark background and the blue cubes.

Machine Learning

FIT—Learning Feedback in Intelligent Tutoring

```
1 public class Recursion {
2     public static void main(String[] args) {
3         Recursion recursion = new Recursion();
4         int result = recursion.recursive(5);
5         System.out.println(result);
6     }
7
8     public int recursive(int num) {
9         return recursive(num - 1) + num;
10    }
11 }
```

Program: Java messages:

Exception in thread "main" java.lang.StackOverflowError
at Recursion.recursive(Recursion.java:9)
at Recursion.recursive(Recursion.java:9)
at Recursion.recursive(Recursion.java:9)
at Recursion.recursive(Recursion.java:9)

```
public class Recursion {
    public static void main(String[] args){
        Recursion recursion = new Recursion();
        int result = recursion.recursive(5);
        System.out.println(result);
    }

    public int recursive(int num) {
        if(num > 0) {
            num = recursive(num - 1) + num;
        }
        return num;
    }
}
```

Feedback:

The system has determined a certain similarity between your program and the program shown above. Compare the two programs and modify your program if necessary.




Please rate the feedback
(helpful, fair, not helpful):   

Fig. 1 Application of feedback principles (1) and (3) in the domain of Java programming. A student is prompted to reflect her solution attempt (illustrated on the *left*) and to compare it to the next step of a correct example (illustrated on the *right*)

Risks/Criticisms of Adaptive Learning

- Assumes learning is linear and cumulative
- Conflicting pedagogical models
- May increase student disengagement
- “Adaptive Learning Is An Infinite iPod That Only Plays Neil Diamond” (Meyer, 2014)



Summary Activity 3

- Intelligent Tutoring Systems | Adaptive Learning Systems
- Individualization | Differentiation | Personalization
- Content Models | Learner Models | Instructional Models
- Facilitator Driven | Assessment Driven





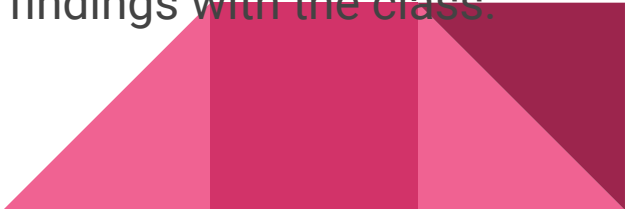
Activity 4: Tool Review, Comparison, & Discussion

Tool Demo: Knewton Adaptive Learning Platform



[Live Demo](#)

Activity 4: Learning & Knowledge Growth Tools

- 20 min Break + Tool Investigation Activity
 - Locate this paper online: *Learning to Adapt: Understanding the Adaptive Learning Supplier Landscape (Tyton Partners)* http://tytonpartners.com/tyton-wp/wp-content/uploads/2015/01/Learning-to-Adapt_Supplier-Landscape.pdf
 - Choose one of the adaptive learning tools that interest you. Review that section of the paper and explore the tool online. Play around with it, watch instructional videos, review online resources, and use your critical lens to assess it.
 - Post your notes to the KF and be ready to share your findings with the class.
- 

Adaptive Learning Tools

Tools:

- Cerego Global <https://cerego.com/>
- CogBooks <https://www.cogbooks.com/>
- Jones & Bartlett Learning (Navigate 2) <http://www.jblnavigate.com/>
- LoudCloud <http://loudcloudsystems.com/>
- McGraw-Hill Education (LearnSmart/Connect) <http://connect.mheducation.com/>
- Open Learning Initiative <http://oli.cmu.edu/>
- Smart Sparrow <https://www.smartsparrow.com/>
- Adapt Courseware <http://www.the-fulcrum.com/>
- *I have more if needed...*

Questions:

- What are your overall thoughts about the tool?
- Who is the intended audience?
- What does the tool intend to solve/help?
- What is an advantage of this tool?
- What is a disadvantage of this tool?
- What do you like most about the tool?
- What type of content model is used?
- What type of assessments are used?
- Does the tool include any individualization, differentiation, or personalization?

Wrap-up

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Thank you!