Linking learning analytics to enrich students' digital learning footprint in an adaptive learning system

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CONTENT

1 Background

2 Learner Profiling: Towards Holistic Education

3 Adaptive Learning System

1

PART ONE

Background

Adaptive Learning

Adaptive Learning

Intelligent tutoring systems (ITS)

Adaptive educational hypermedia systems (AEHS)

Adaptive Learning

Exact Path

edapp by SafetyCulture

Adaptemy

Knewton A Wiley Brand

CogBooks

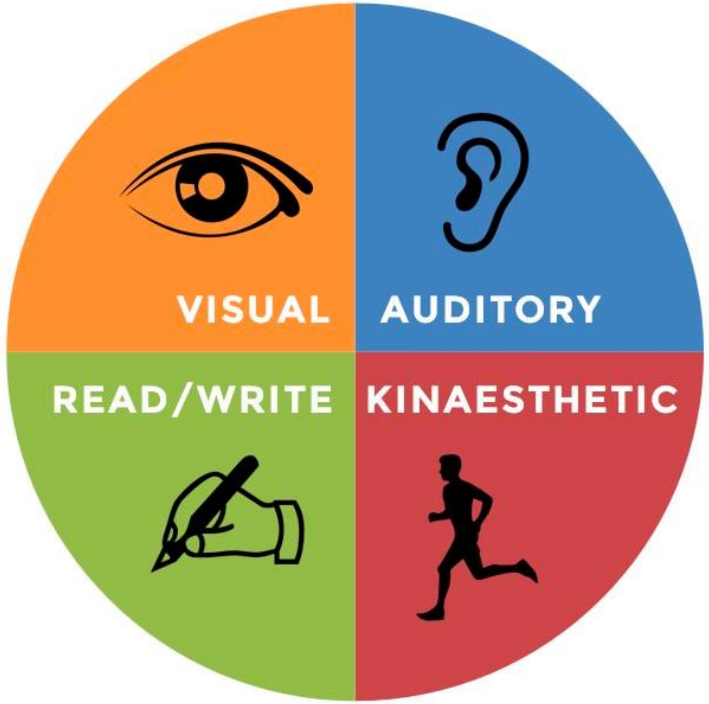
松鼠AI 智适应教育

The vast majority of mature adaptive learning applications on the market focus on learner knowledge acquisition.

Adaptive Learning

Adaptive Learning

- The majority of the studies occurred in **higher education** with the highest concentration in the **computer science** discipline.
- **Learning style** was the most observed learner characteristic, while **adaptive feedback and adaptive navigation** were the most investigated adaptive targets.



Martin, F., Chen, Y., Moore, R. L., & Westine, C. D. (2020). Systematic review of adaptive learning research designs, context, strategies, and technologies from 2009 to 2018. Educational Technology Research and Development, 68, 1903-1929.

Adaptive Learning

Learner characteristics	Number of studies	Adaptive source measuring learner characteristics
Learning style	14	Felder-Silverman Learning Style Model, VARK Questionnaire, Kolb's learning style inventory, Solomon and Felder ILS inventory, Keefe's learning style test
Cognitive style and thinking style	8	Swellerm van Merrienboer and Paas, Pask's Holist–Serialist dimension, Witkin's GEFT test, Student preferences for content and components
Learner prior knowledge and background knowledge	8	Pretest, knowledge test, psychological tests for initial comprehension level
Learner knowledge and metacognitive knowledge	6	Content result, semantic description
Learner preference	4	Ignatian teaching methods
Learner behavior	3	Time spent
Learner profile	3	Log data
Learner ability	2	Proficiency level
Multiple learner characteristics	2	Learner needs and personal characteristics, self-efficacy and learning efficiency
Learner interest	1	Student interest survey

Adaptive source (learner characteristics) in adaptive framework mainly focused on learning style, cognitive style and learner prior knowledge and background knowledge (Martin et al., 2020; Normadhi, et al., 2019)

Normadhi, N. B. A., Shuib, L., Nasir, H. N. M., Bimba, A., Idris, N., & Balakrishnan, V. (2019). Identification of personal traits in adaptive learning environment: Systematic literature review. Computers & Education, 130, 168-190.

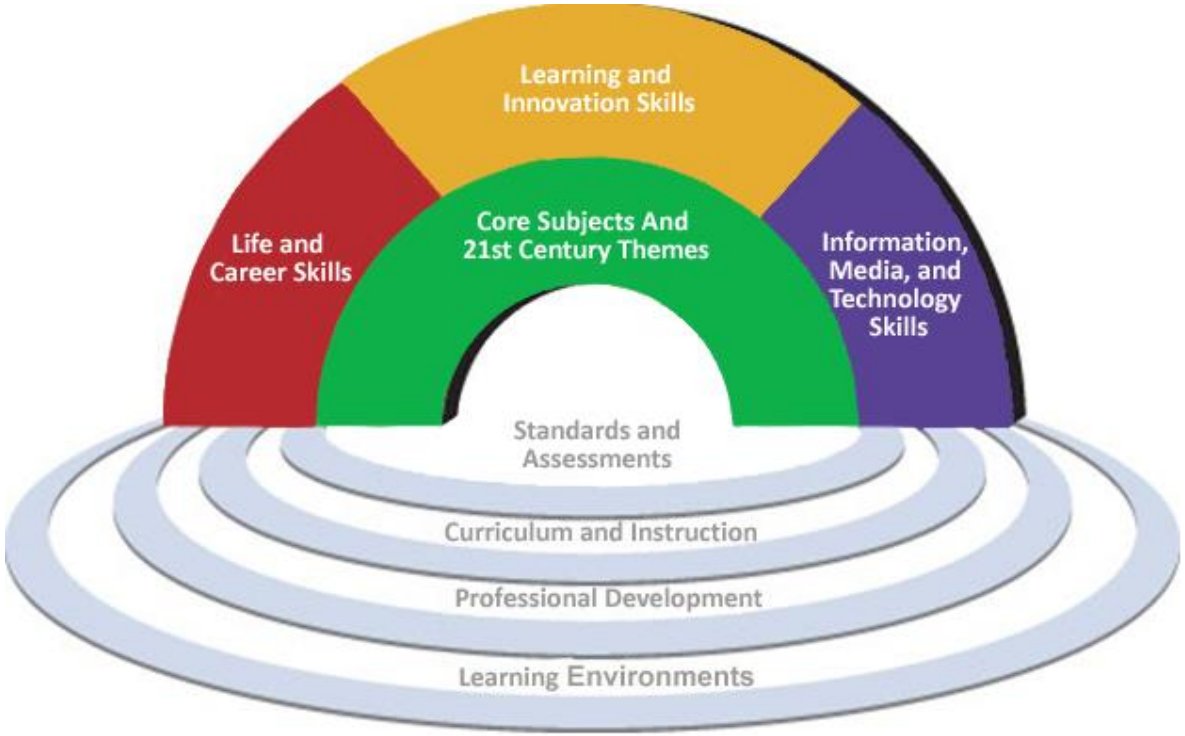
Adaptive Learning System

Focused on
knowledge acquisition only

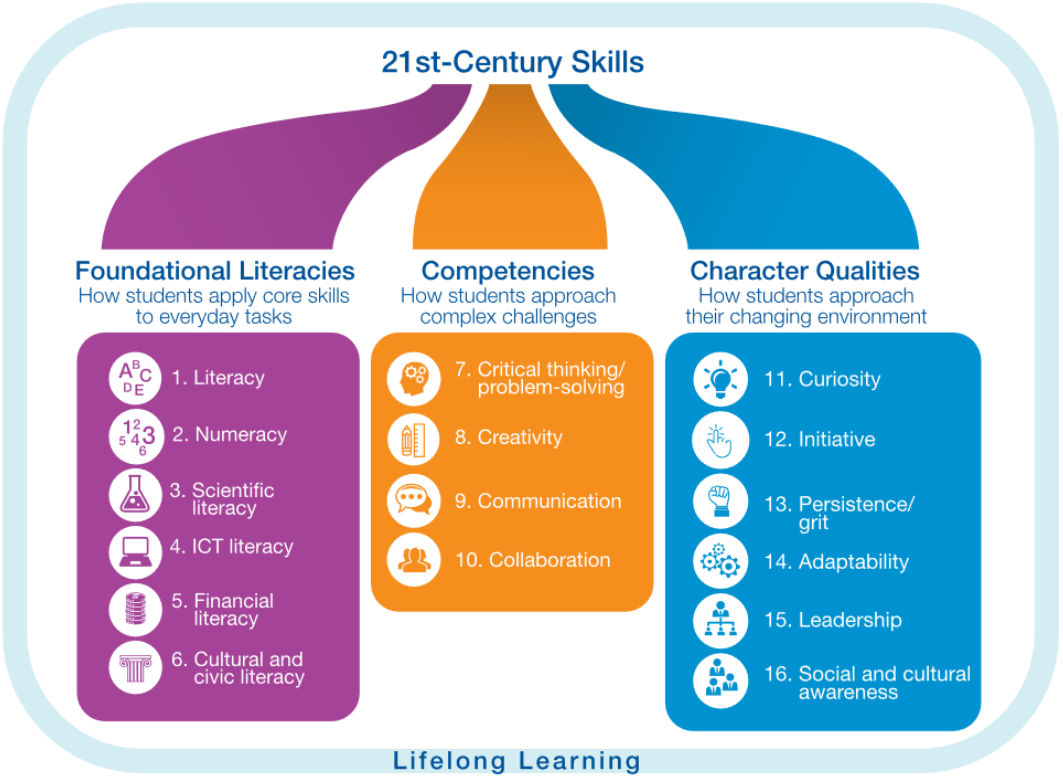
→

A full-scale learner profile

Adaptive Learning Models



https://upload.wikimedia.org/wikipedia/commons/7/7a/Framework_for_21st_Century_Learning.jpg



http://www.emergingedtech.com/wp/wp-content/uploads/2015/12/WEF-21st-Century-Lifelong-Learning.png

Adaptive Learning

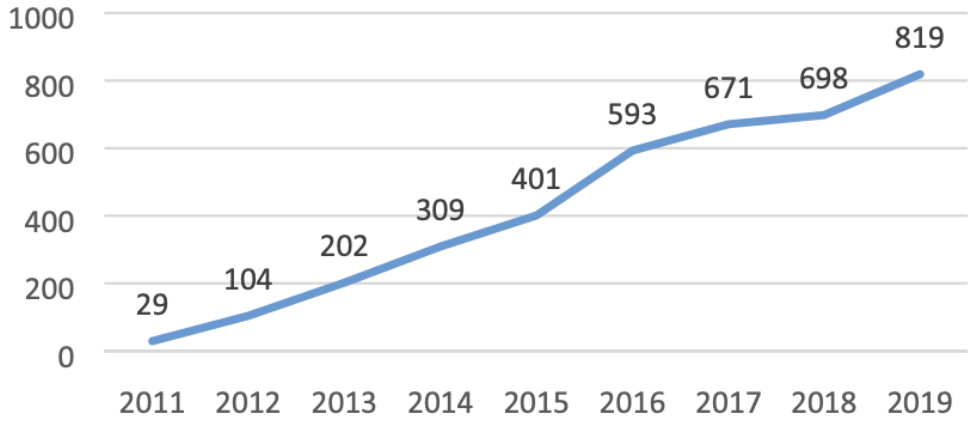
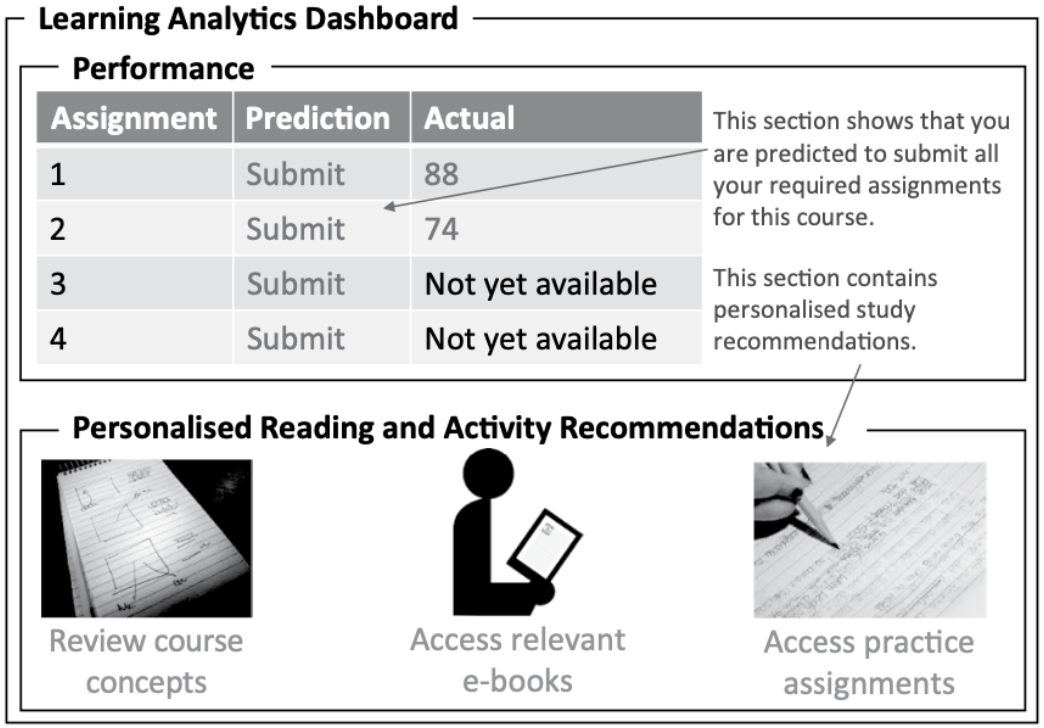


Fig. Number of studies on learning analytics published in the SCOPUS database



Lee, L. K., Cheung, S. K., & Kwok, L. F. (2020). Learning analytics: current trends and innovative practices. Journal of Computers in Education, 7, 1-6.

Korir, M., Slade, S., Holmes, W., & Rienties, B. (2022). Eliciting students' preferences for the use of their data for learning analytics: A crowdsourcing approach. In Open World Learning (pp. 144-156). Routledge.

Adaptive Learning System

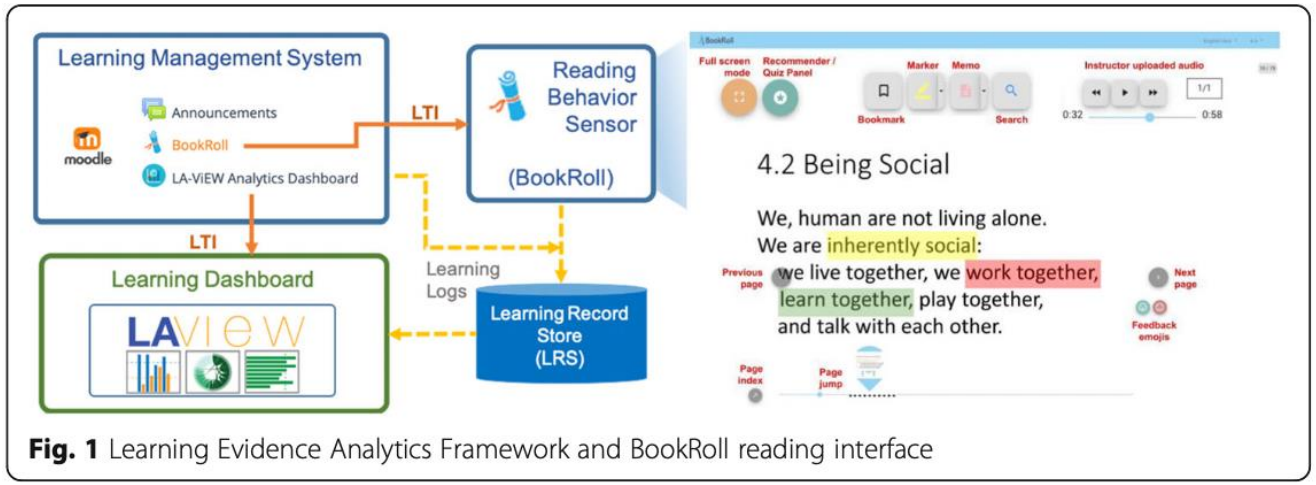


Fig. 1 Learning Evidence Analytics Framework and BookRoll reading interface

Majumdar, R., Bakilapadavu, G., Majumder, R., Chen, M. R. A., Flanagan, B., & Ogata, H. (2021). Learning analytics of humanities course: Reader profiles in critical reading activity. Research and Practice in Technology Enhanced Learning, 16(1), 25.

2

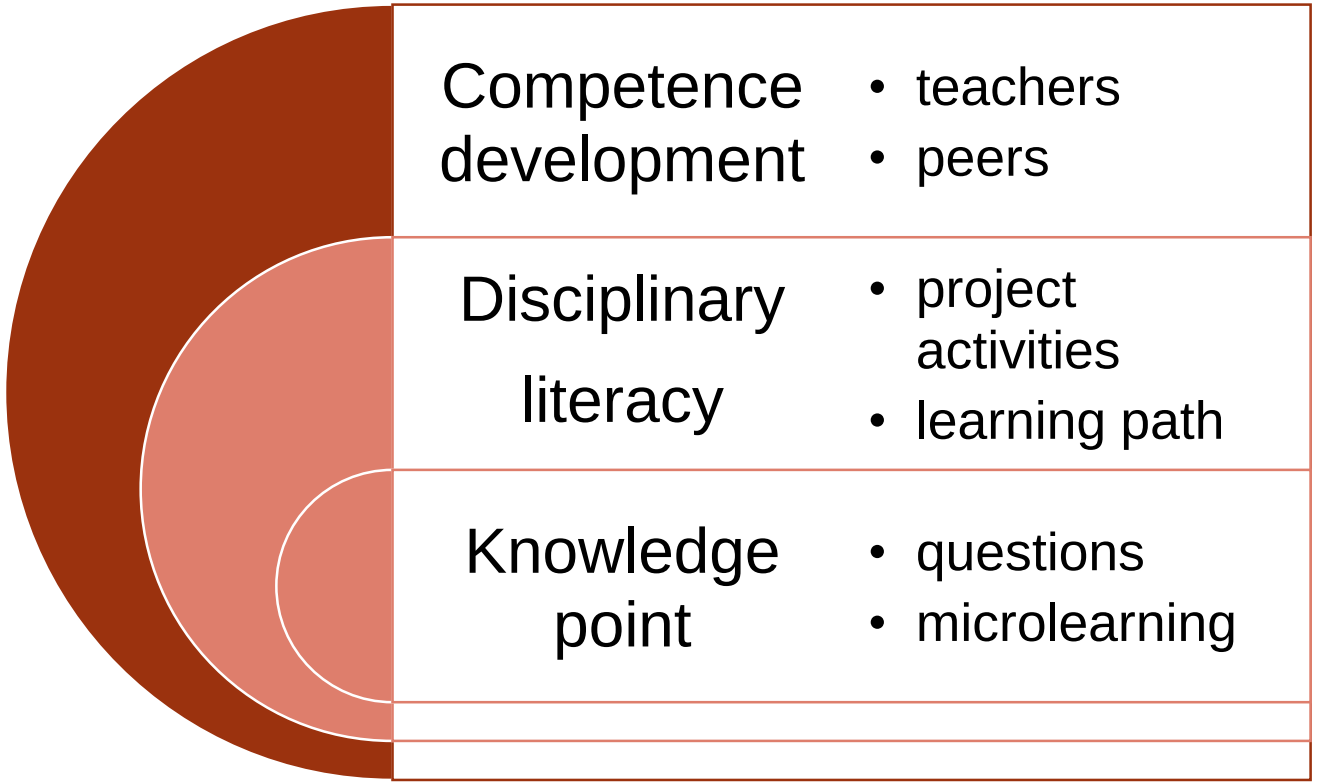
PART ONE

Learner Profiling:

Enrich digital learning footprint

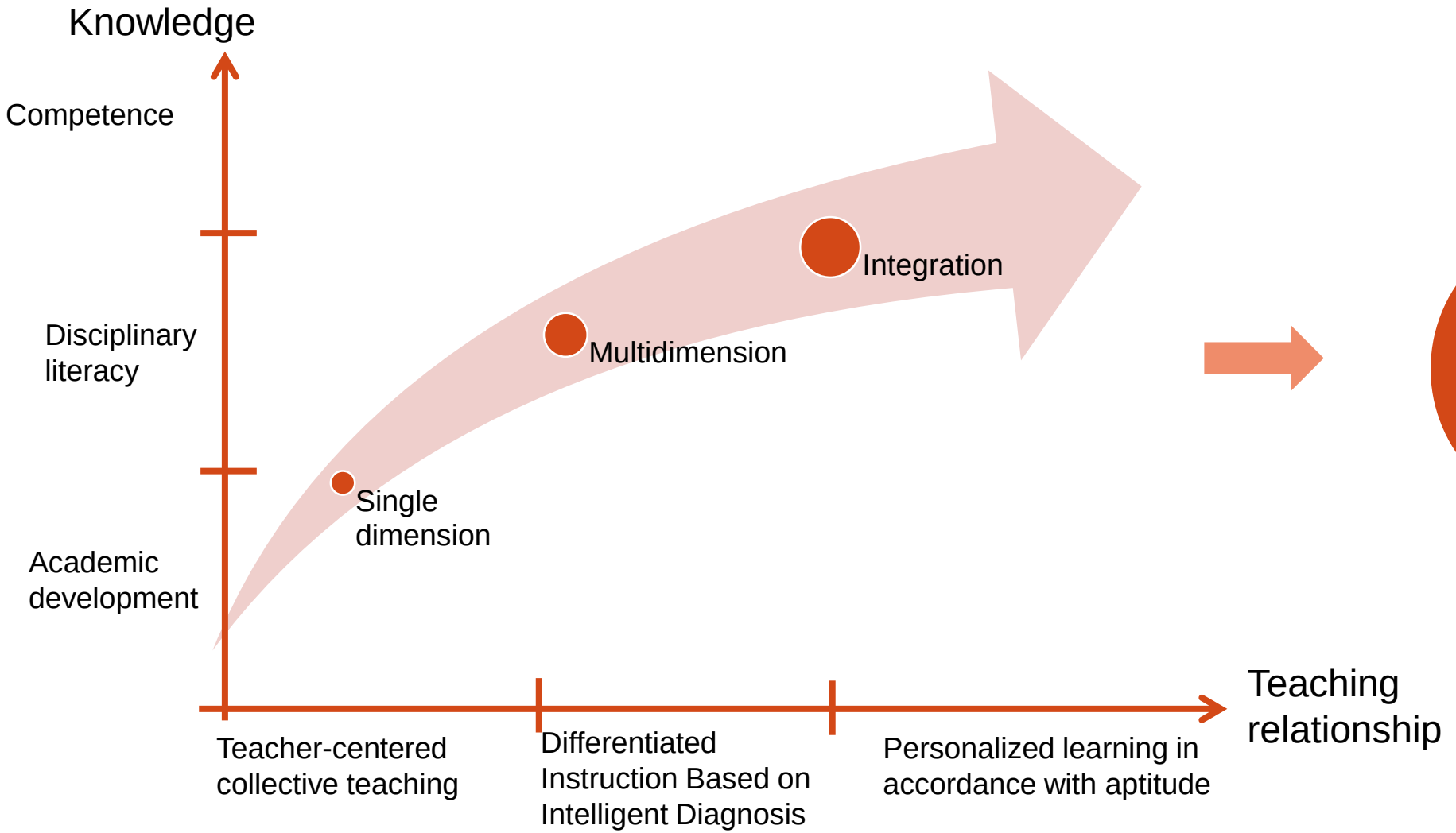
Trend: from know acquisition to competence development

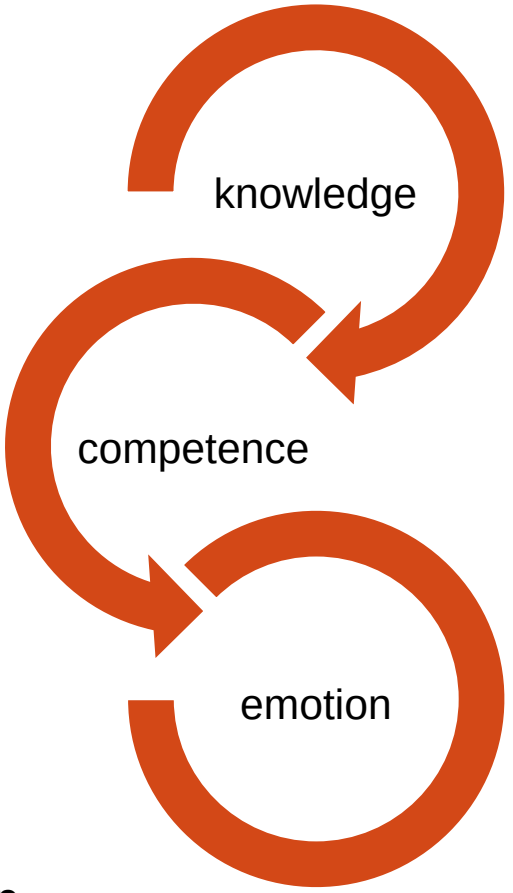
Adaptive to what learning goals



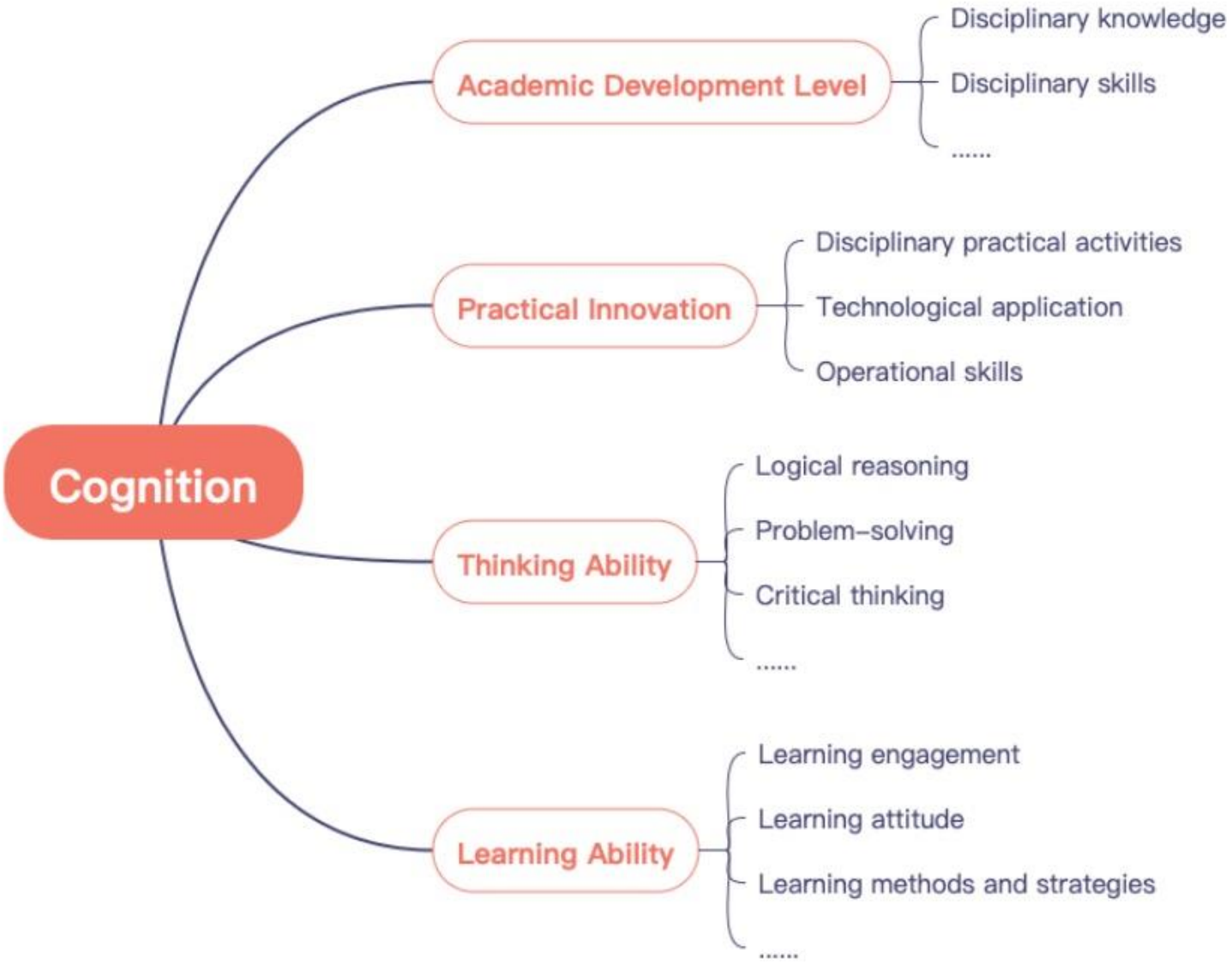
Cases of adaptive learning support

Trend: from independent domain knowledge to comprehensive competence

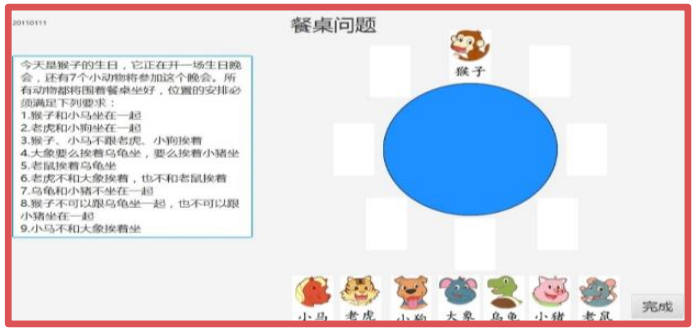




Learner Profiling



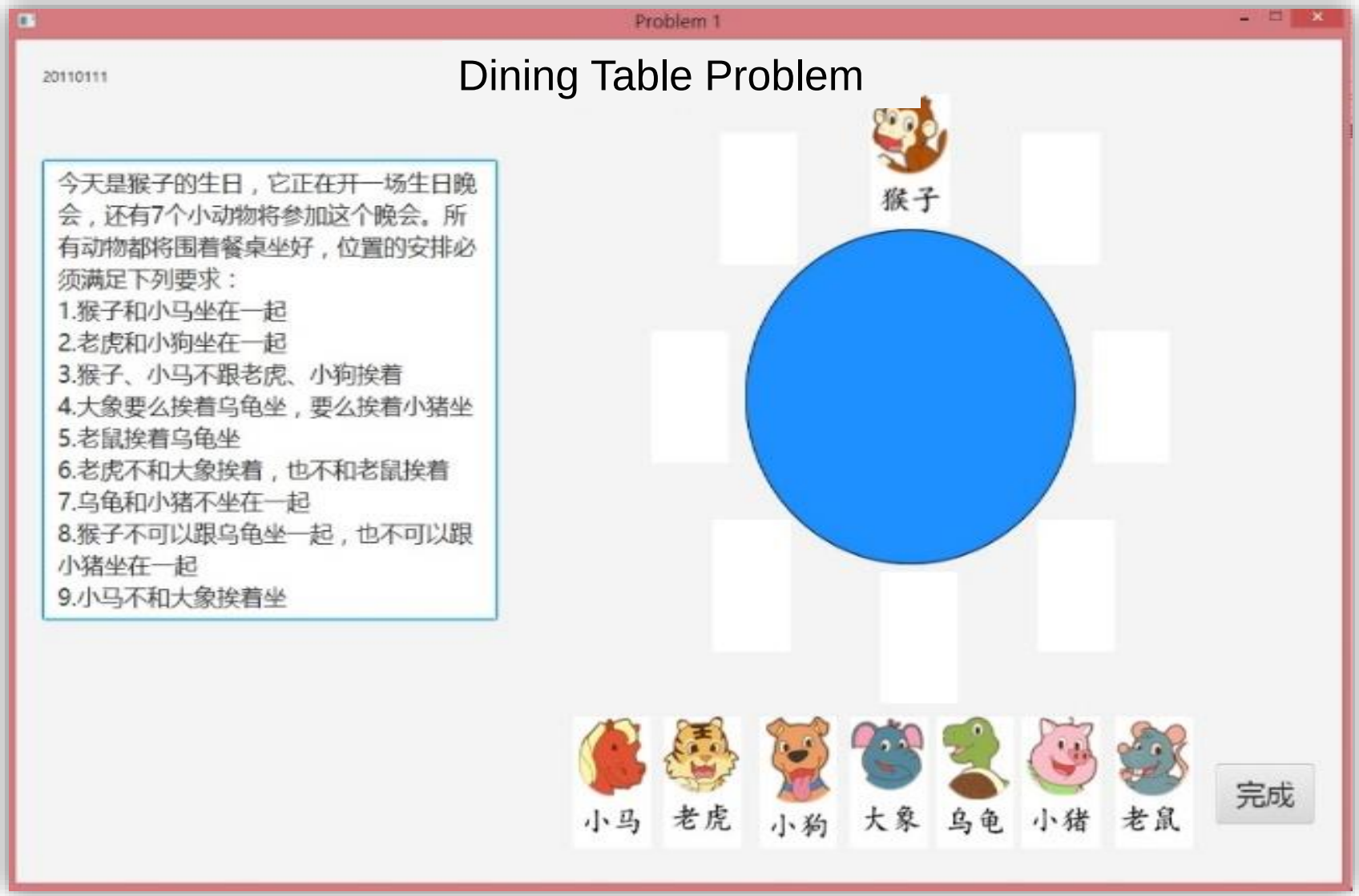
simulated tasks



Design of learning scenarios, virtual learning environments, gamified online learning environments...

Complex problem solving **Critical thinking** **collaborative learning** **Design thinking** **……**

Learner Profiling


Problem 1
20110111
Dining Table Problem
今天是猴子的生日，它正在开一场生日晚会，还有7个小动物将参加这个晚会。所有动物都将围着餐桌坐好，位置的安排必须满足下列要求：
1.猴子和小马坐在一起
2.老虎和小狗坐在一起
3.猴子、小马不跟老虎、小狗挨着
4.大象要么挨着乌龟坐，要么挨着小猪坐
5.老鼠挨着乌龟坐
6.老虎不和大象挨着，也不和老鼠挨着
7.乌龟和小猪不坐在一起
8.猴子不可以跟乌龟坐一起，也不可以跟小猪坐在一起
9.小马不和大象挨着坐
猴子
小马
老虎
小狗
大象
乌龟
小猪
老鼠
完成

Learner Profiling

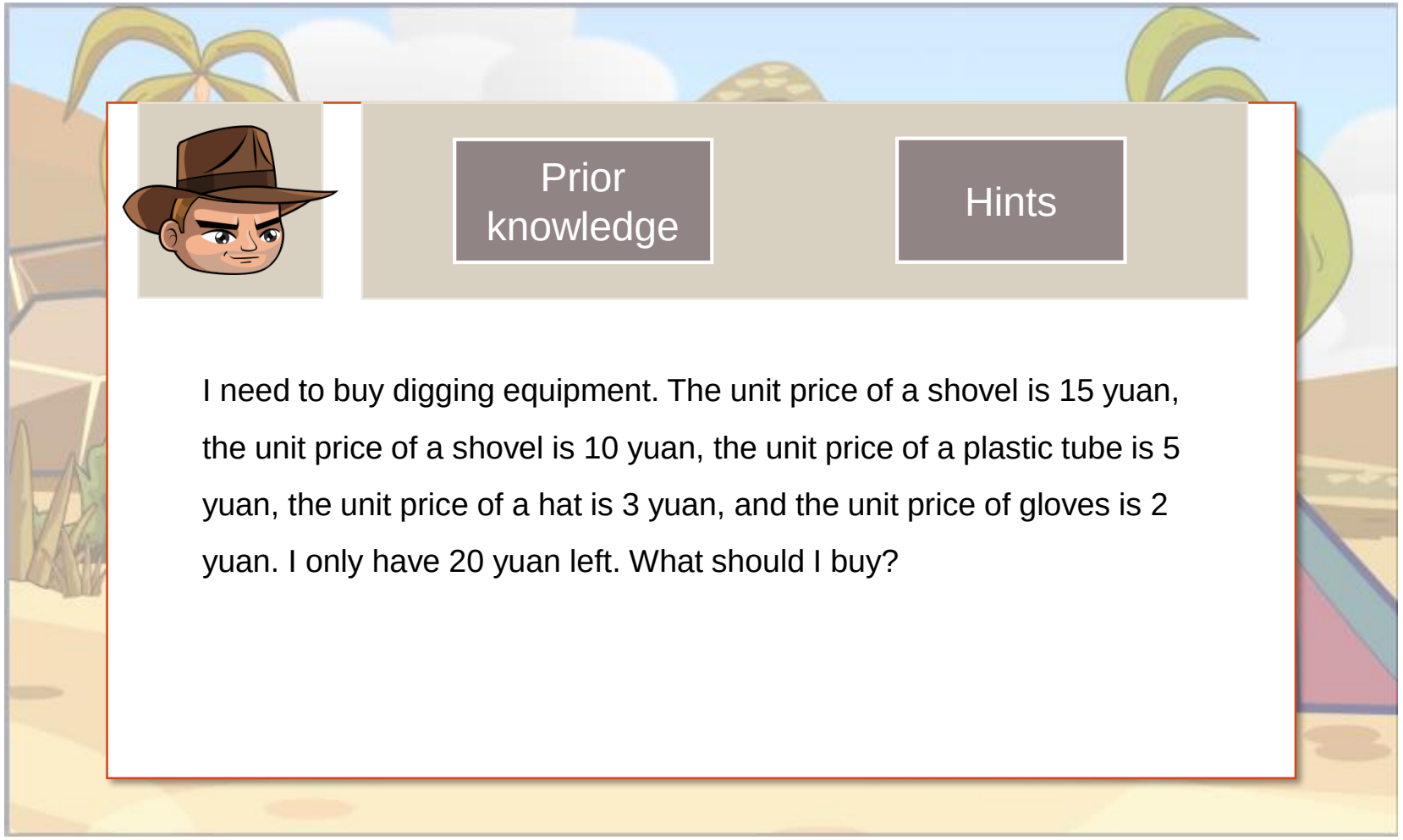
Course Selection

Personal Center

compulsory education

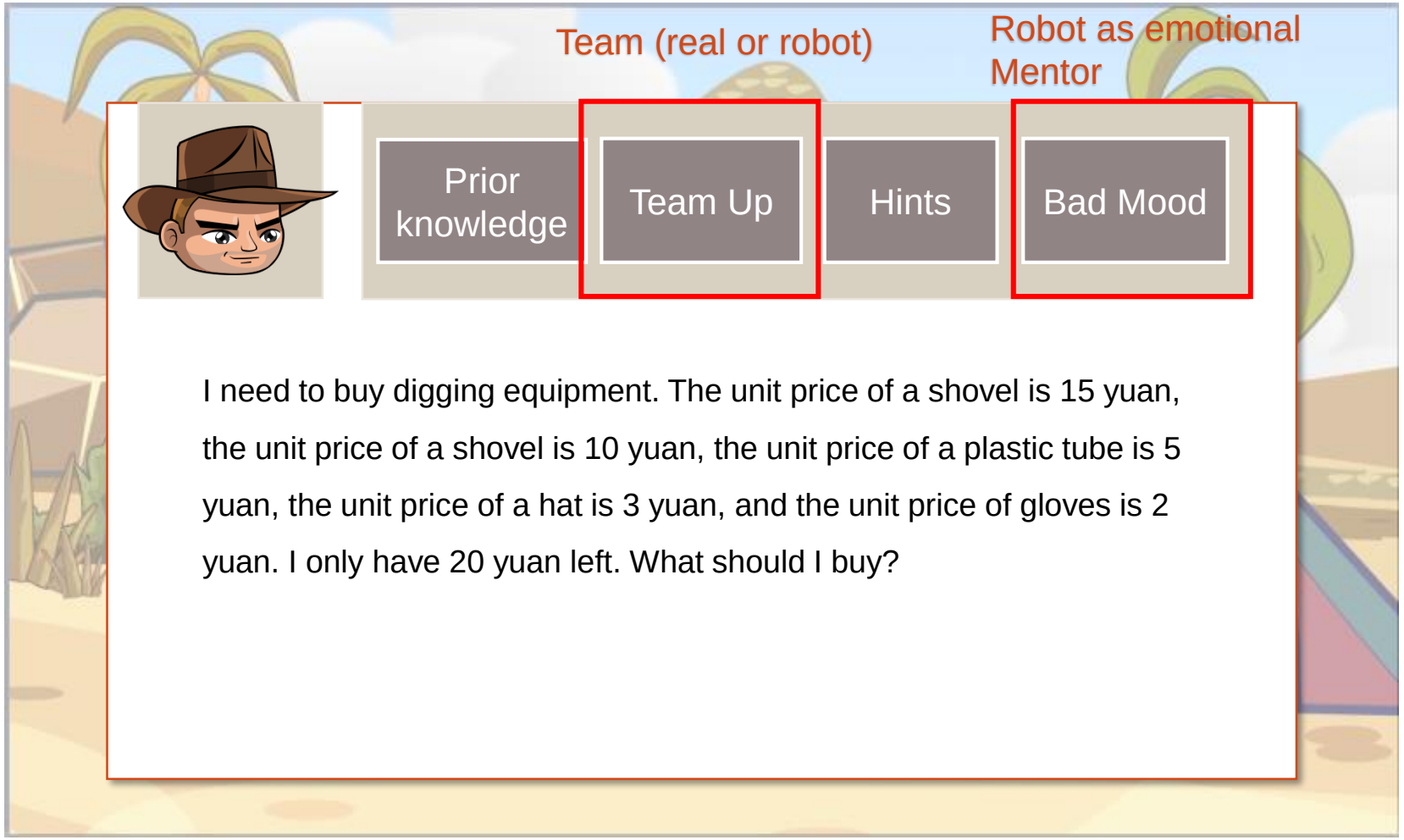
Gamification Design

Learning Tasks: Learning in context



Learner Profiling

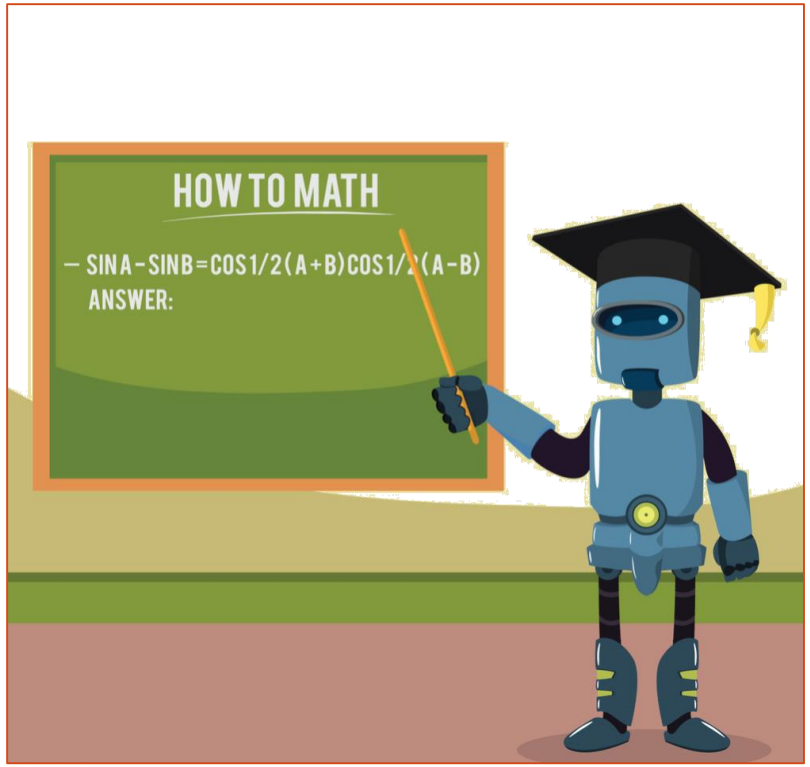
Learning Tasks: Learning in context



Learner Profiling

AI

Q & A



Robot as Emotional Mentor

Chat

Lily, Are you in a bad mood today?

It was fine.

Is the question too hard?

Yes, I cannot understand even with the hints.

But you did a good job in task one.

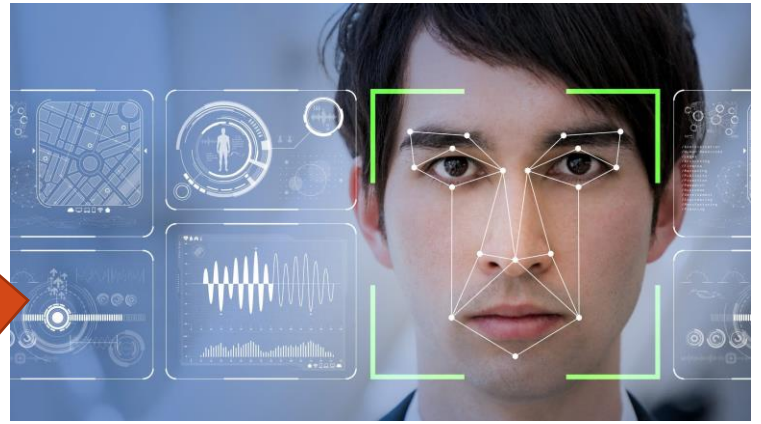
But taks two is hard.

No worries. Let's find out how to solve it.

Great!

Learner Profiling

Full-scale
Learner Profile



Learner Profiling

Knowledge

Competency

Emotion

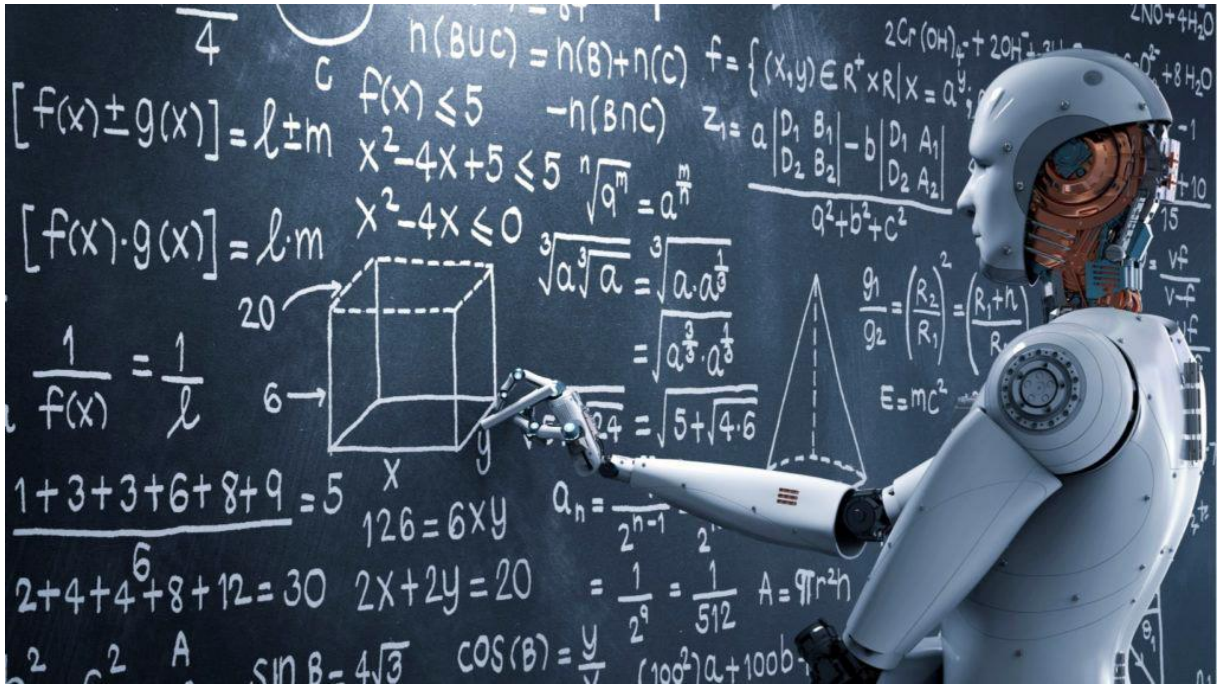
Machine learning technology

Outputs of diagnoses

Adaptive learning path

Adaptive Learning System

- Learning analytics
- a full-scale learner profile
- approaching learners' need



3

PART ONE

Adaptive Learning System

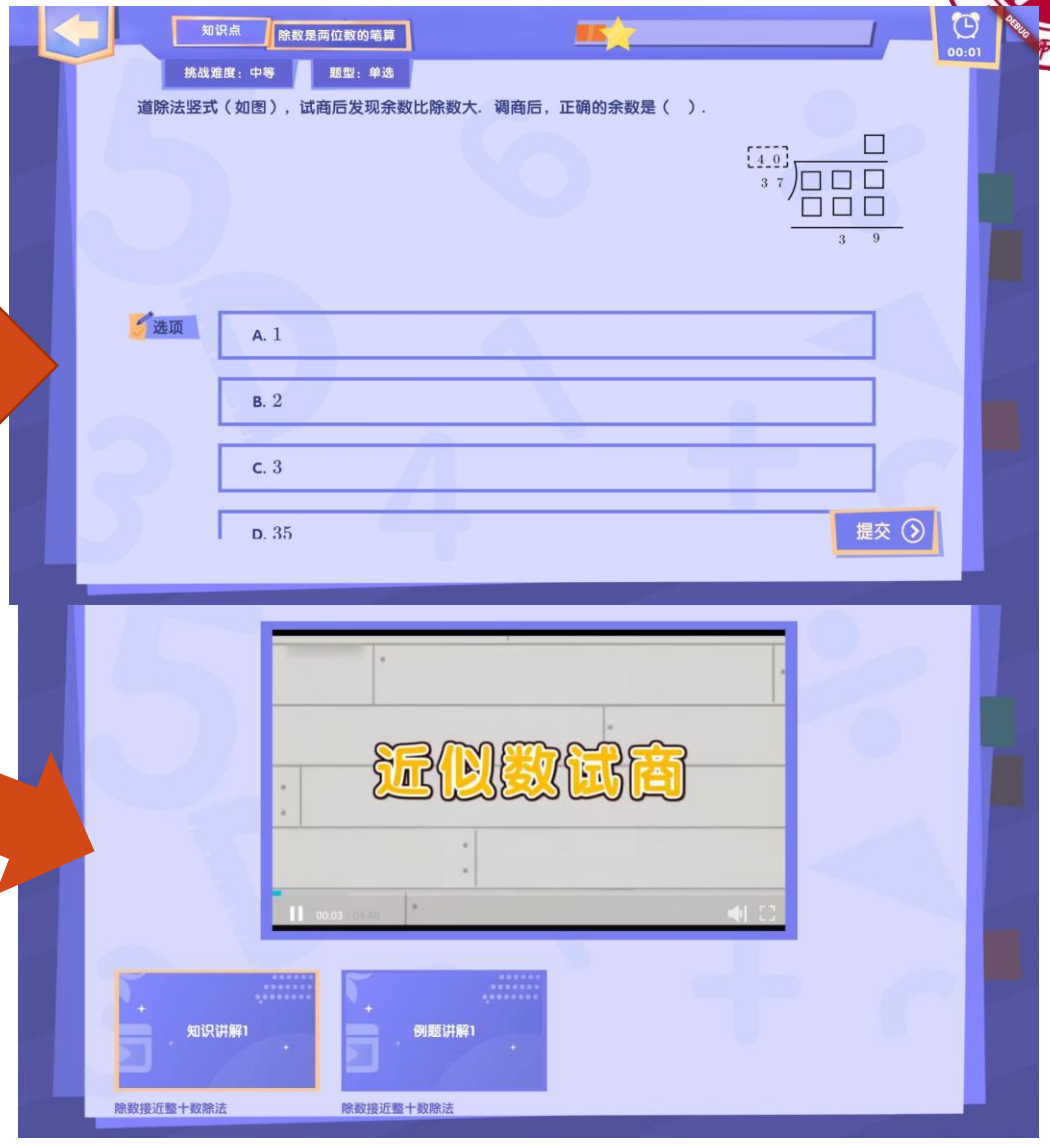
Adaptive Learning System

Tutoring

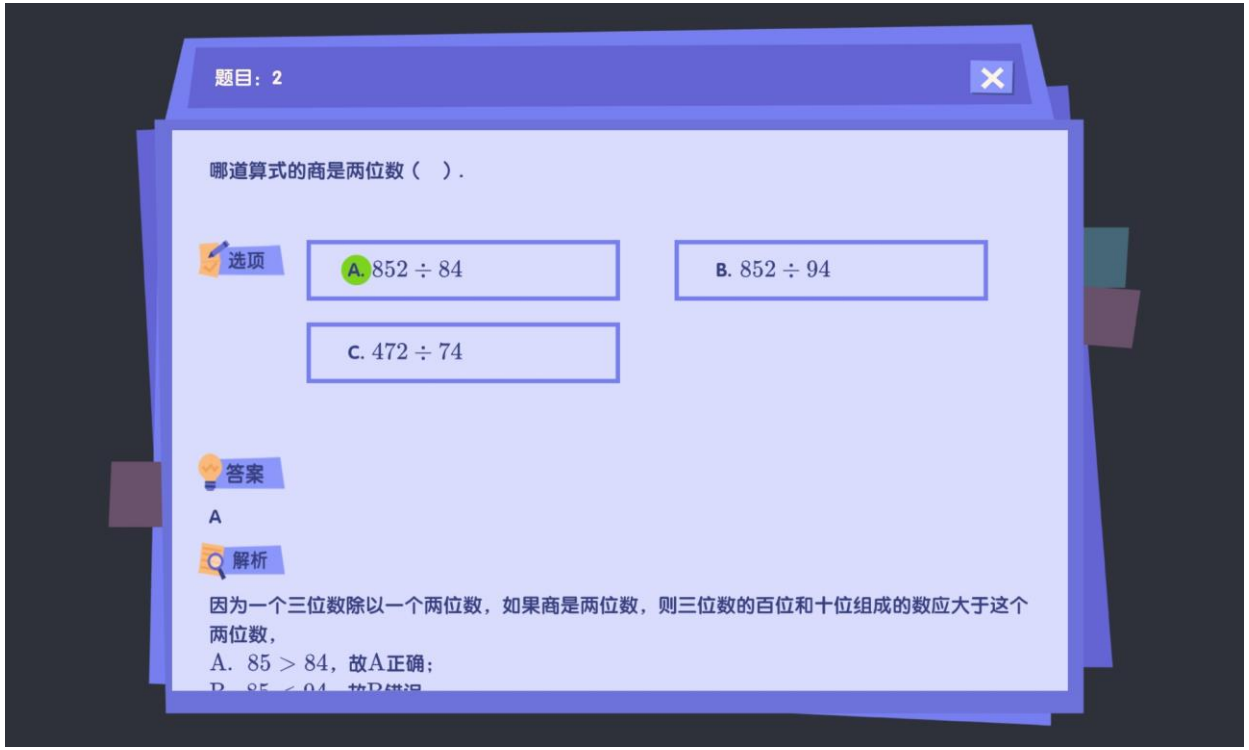
A part of learner profile

Challenging learning activities

Adaptive Learning System



Adaptive Learning System

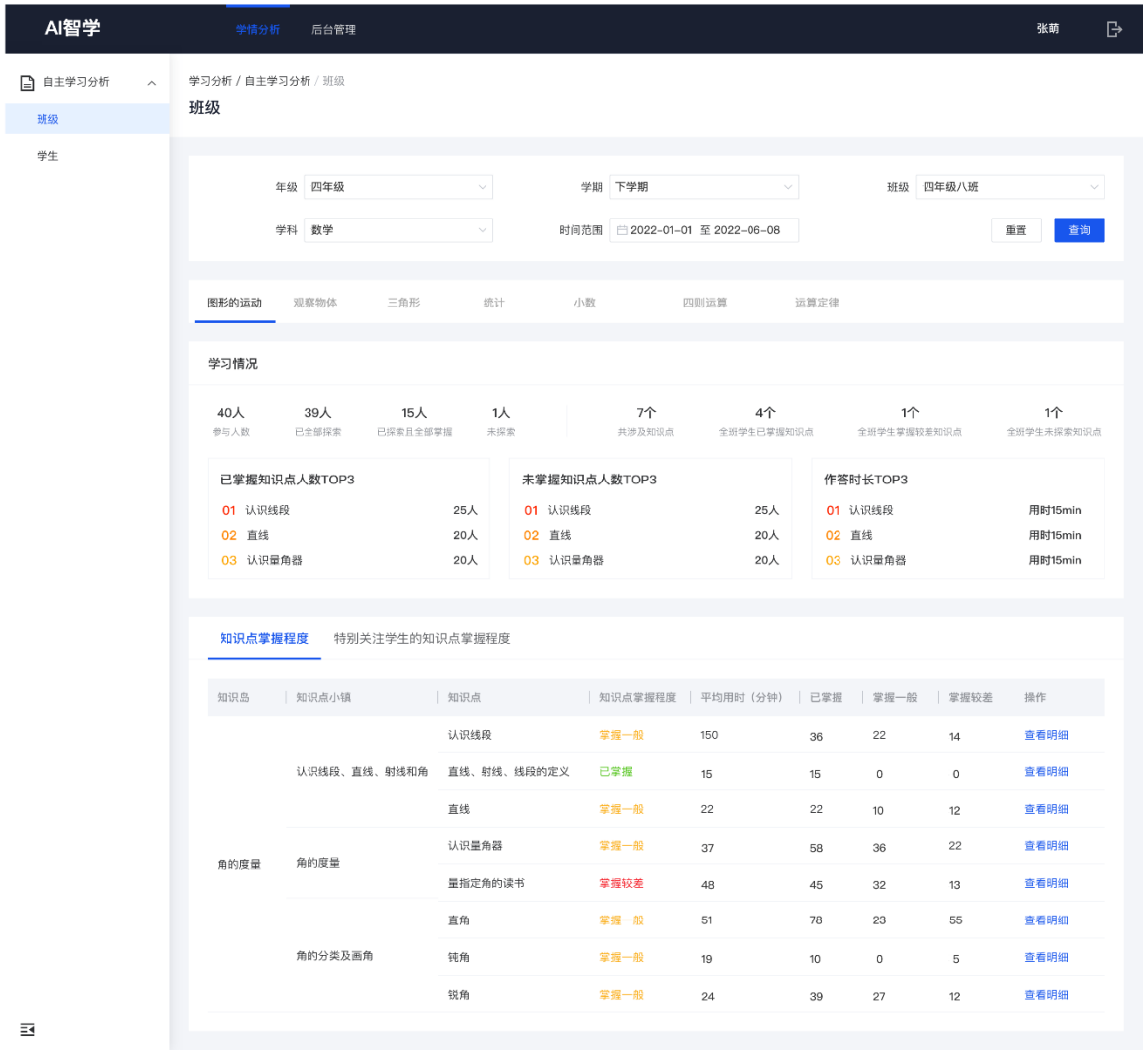


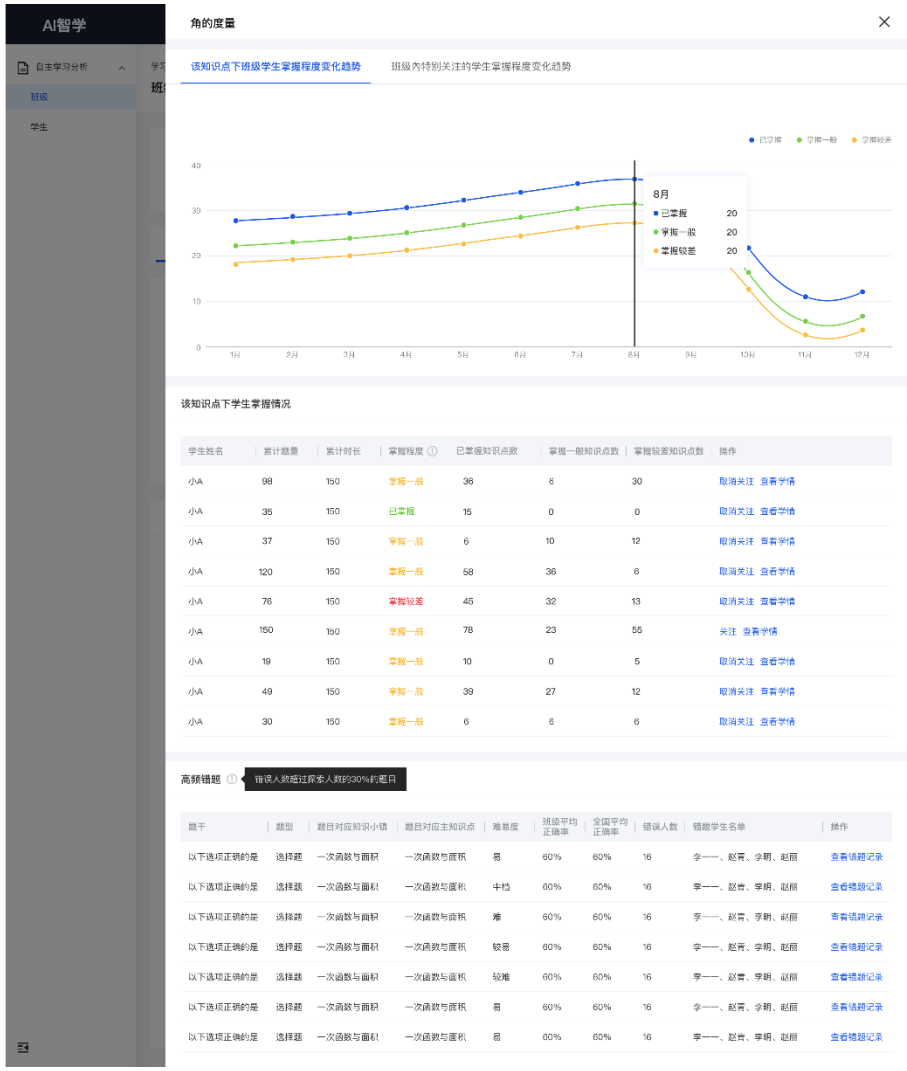
Adaptive Learning System

Adaptive Learning System

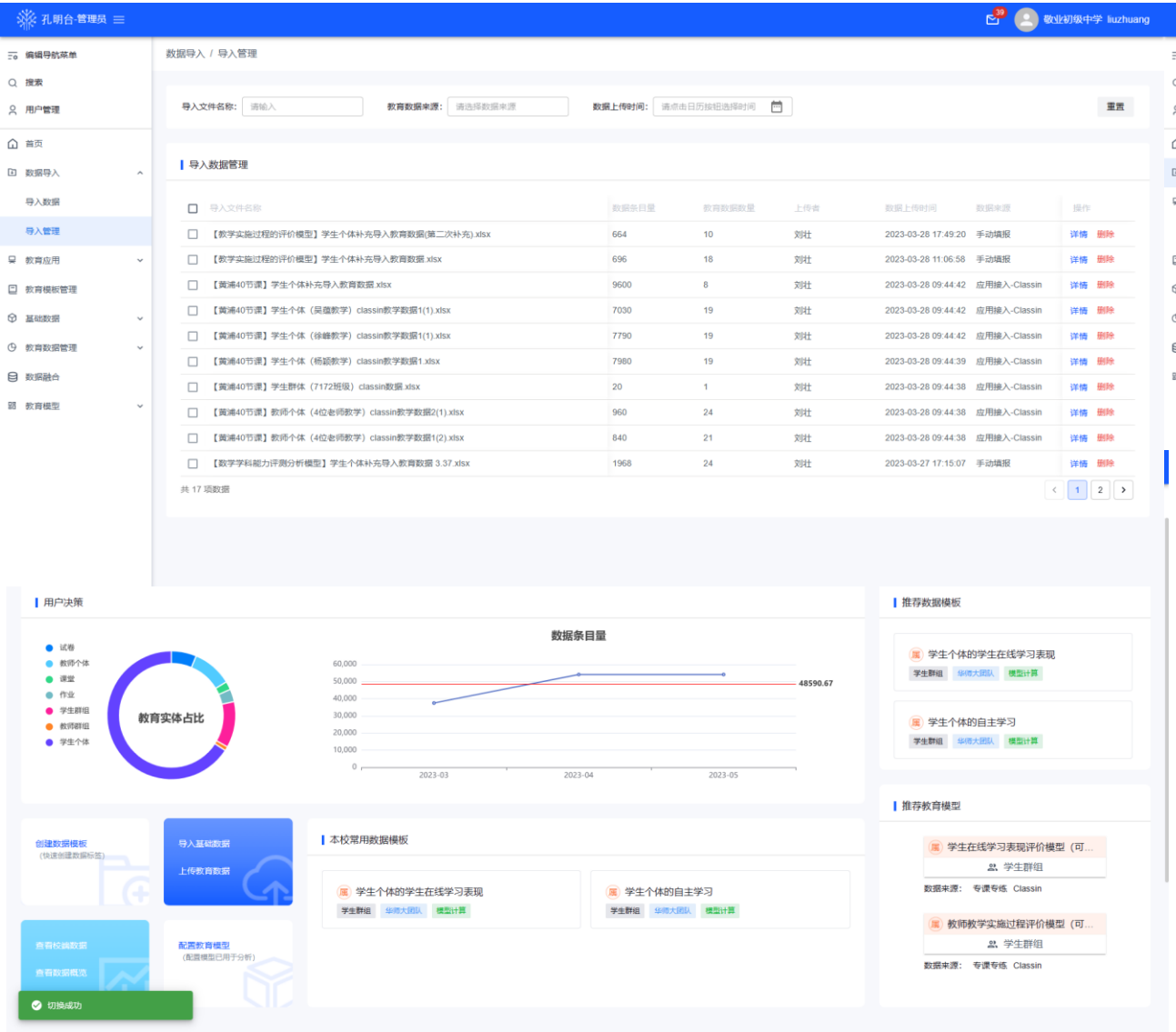
- Overview of Mastery of Knowledge Islands
- Details of Knowledge Points
- Distribution of Mastery of Knowledge Town
- Distribution of Questions of Different Difficulties in Knowledge Town

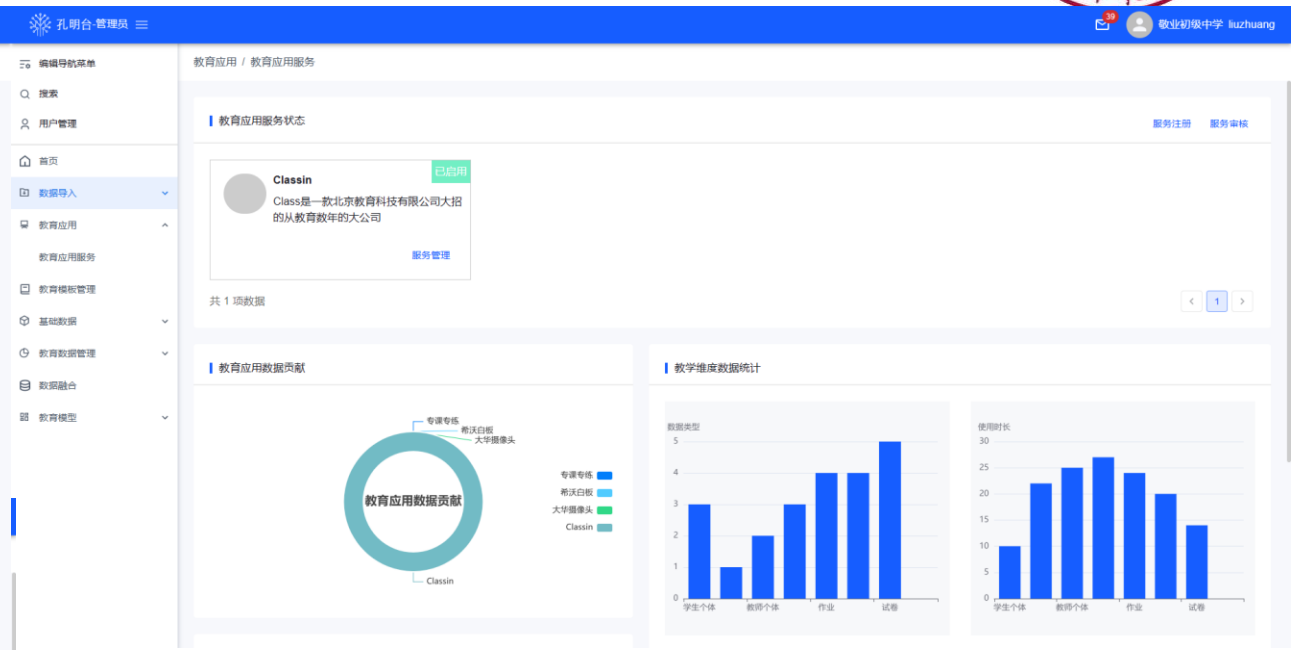
Adaptive Learning System





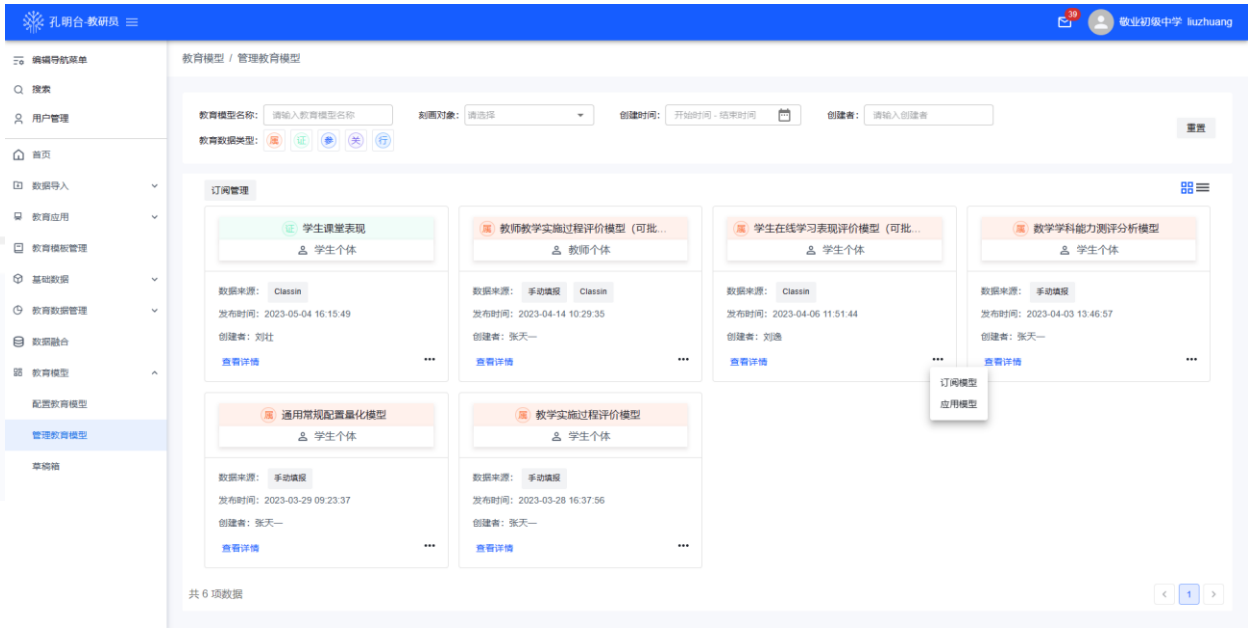
Adaptive Learning System





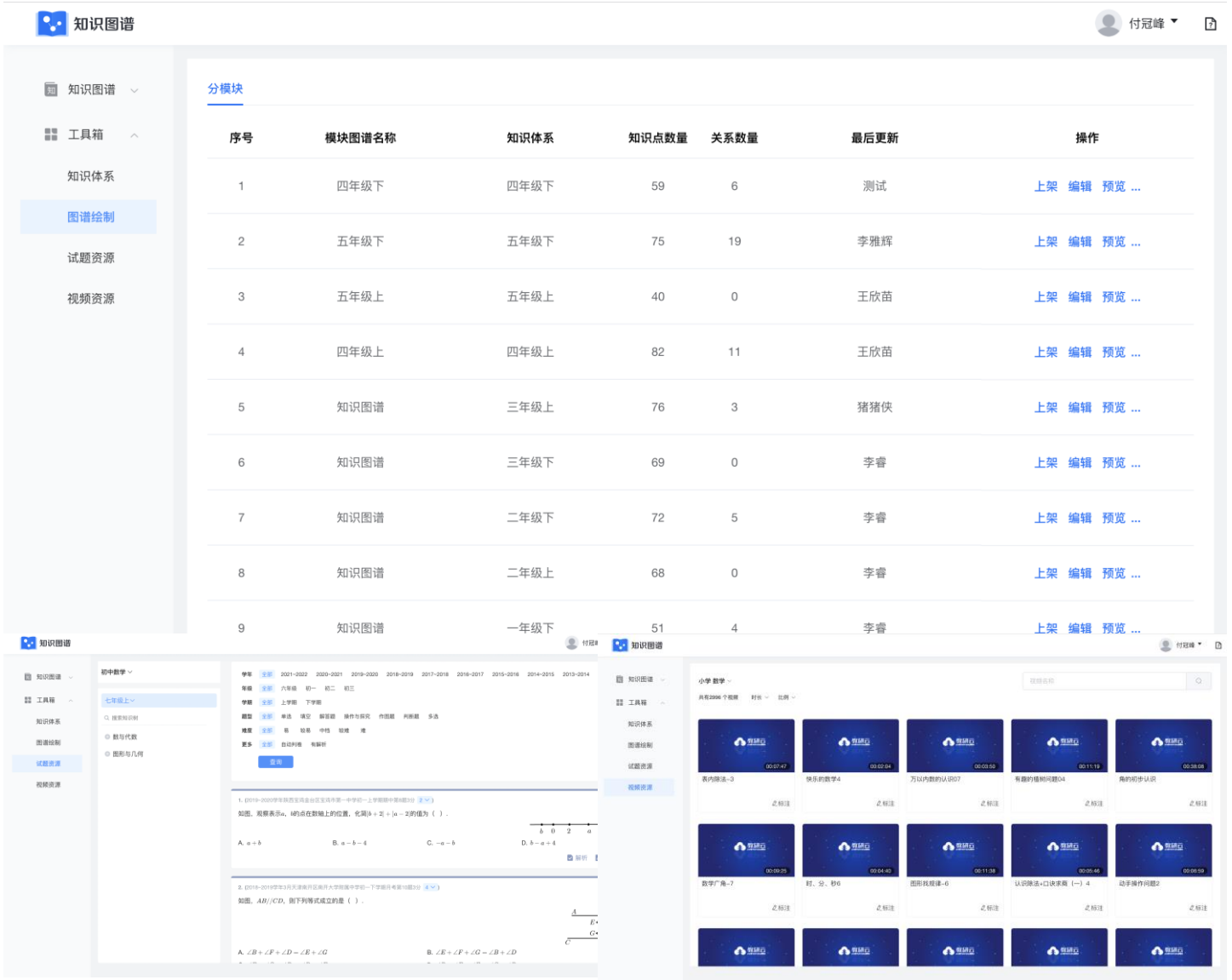
Learning analytics

Adaptive Learning System



Enrich students' digital learning footprint

Adaptive Learning System



System Application

- **Application Period**
  October to December 2022
- **Cover schools**
  18 schools in Shanghai, Jiangsu, and Sichuan provinces in China, covering 47 classes and 1887 students in grades 4-7
- **Application models**
  Pre-class Preview/In-class Learning/Post-class Preview/Interest Exploration/At-home Learning.

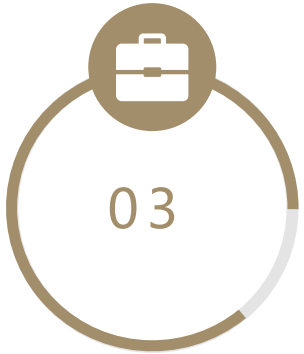
System Application

Pre-class Review

Students to use the system to preview the content of the next class on campus.

In-class Learning

The learning system videos are played collectively in the classroom, with adaptive exercises as classroom practice questions.



Post-class Review

At school, students use the system for independent review of the content learned in the previous class.

Interest Exploration

At school, students explore the system's theme-based learning freely, and their self-study ability and effectiveness are measured based on their self-study situation.

Self-study at home

Backward students from each grade are selected to use the system independently at home to make up for their deficiencies.

System Application

Students responses:

- the materials in the system are very interesting.
- the questions are nice, very challenging, and can stimulate learning interest.
- the videos are very interesting, and I can easily understand the content.
- the learning interface looks great.
- the videos can help use review the contetn learned in class.
- the system encourages use after completing the questions.

Teachers responses:

- this system makes students' practice more extensive and have the chances to answer more diverse types of questions.
- encountering difficult problems may stimulate students' enthusiasm for learning mathematics
- it can effectively improve students' self-learning ability

Vision afterwards...

- AI Q&A
- AI companion, like Chat

Lily, Are you in a bad mood today?

It was fine.

Is the question too hard?

Yes, I cannot understand even with the hints.

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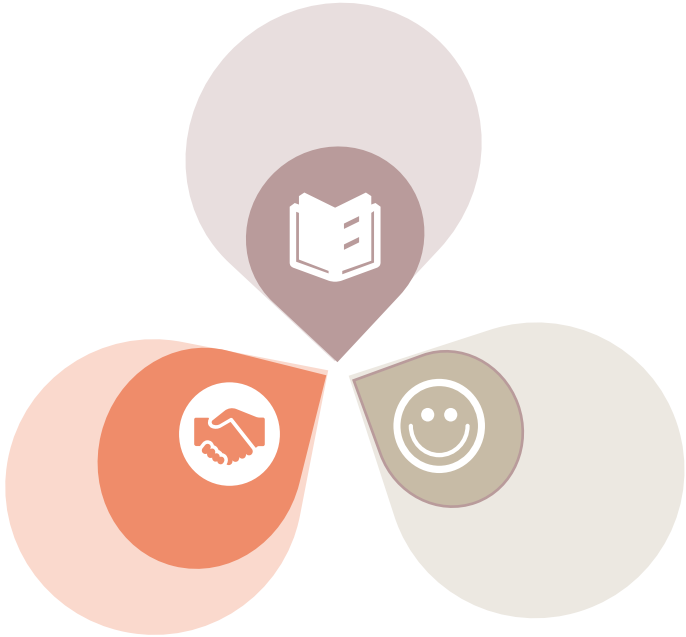
No worries. Let's find out how to solve it.

Great!

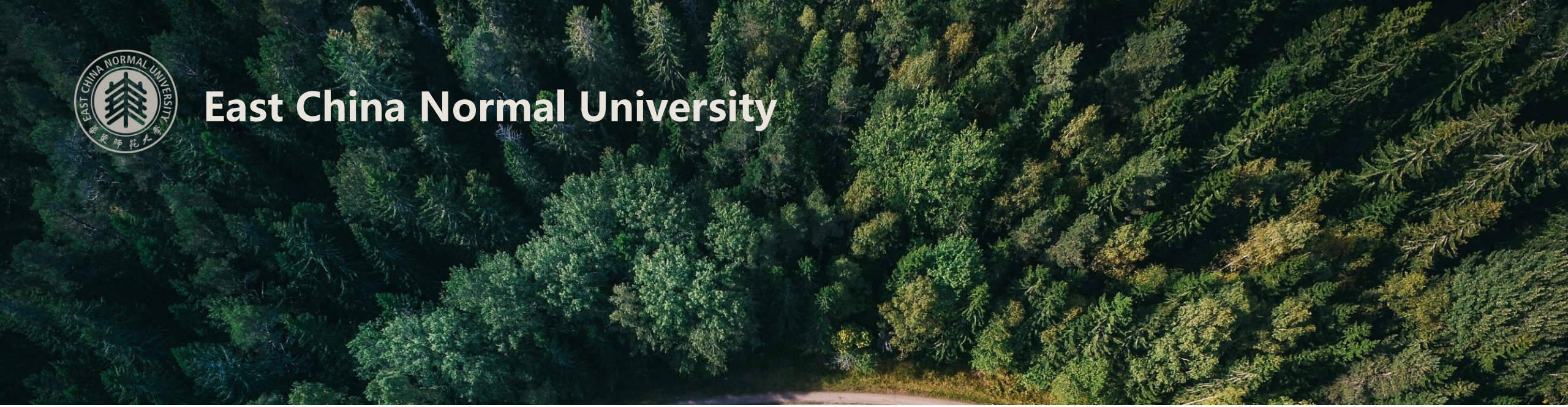
Adaptive Learning System



Knowledge

Competency

Emotion



THANKS

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