Design of a Ubiquitous Learning Support System based on Behavior Analysis

Zixue Cheng[1], Shengguo Sun[2],
Mizuo Kansen[2], Tongjun Huang[3]

Abstract: In this paper, we present the design of a ubiquitous learning support system based on the behavior analysis of a learner. In the ubiquitous learning environment, it is possible to sense and to observe every learner's behavior or learning habit. Based on the analysis of the behaviors, personalized support suitable for the learner's situation can be provided to the learner.

1: School of Computer Science and Engineering, University of Aizu, Japan
2: Graduate School of Computer Science and Engineering, University of Aizu, Japan
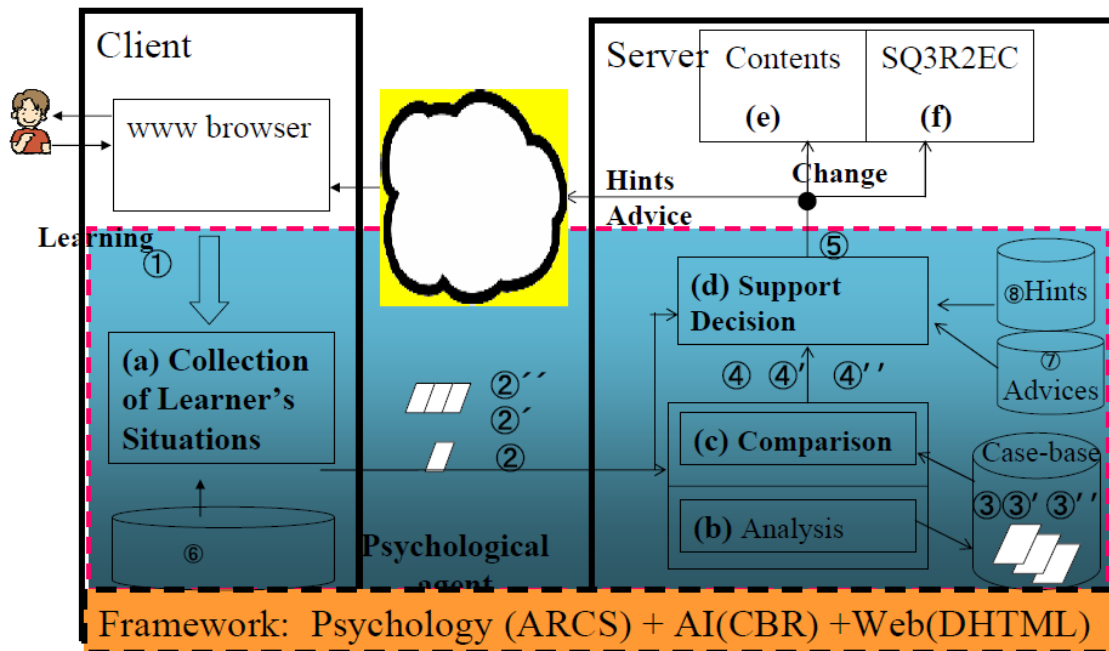3: Information Systems and Technology Center, University of Aizu, Japan

Agenda

- Background
- Behavior Analysis and Management
- Design of the System
- Application Examples

Background:
Ubiquitous Learning

Web based Learning

Psychological Agents

Ubiquitous Computing

Ubiquitous Learning
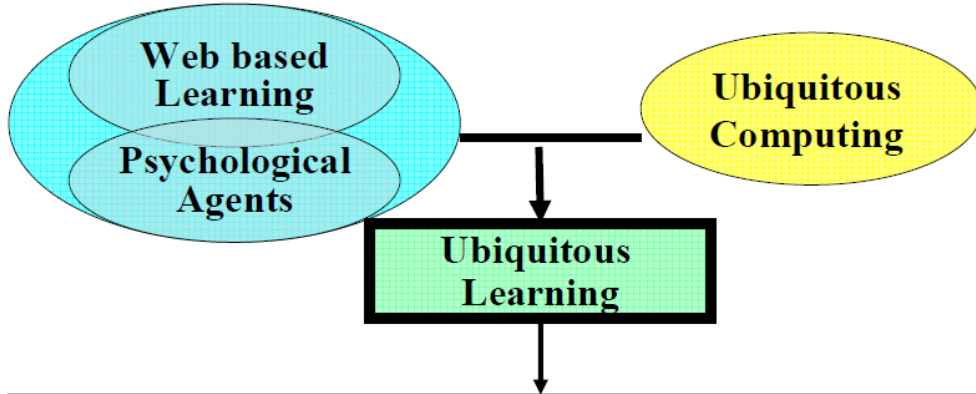
- **Interaction with real objects and environment**
- **Learning process in life, (playing and gaming)**
- **Learner's behavior and psychology can be grasped more correctly and completely**
- **Personalized support in right time and right place, according to the learner's situation**

Background:
Web-based Learning System using Agents

Client

www browser

Server Contents SQ3R2EC

(e) **(f)**

Hints Change
Advice

Learning
①

⑤

(a) Collection of Learner's Situations

(d) Support Decision

④ ④′ ④″

②″
②′
②

(c) Comparison

(b) Analysis

⑥

Psychological agent

⑧Hints

⑦
Advices

Case-base
③③′③″

Framework: Psychology (ARCS) + AI(CBR) +Web(DHTML)
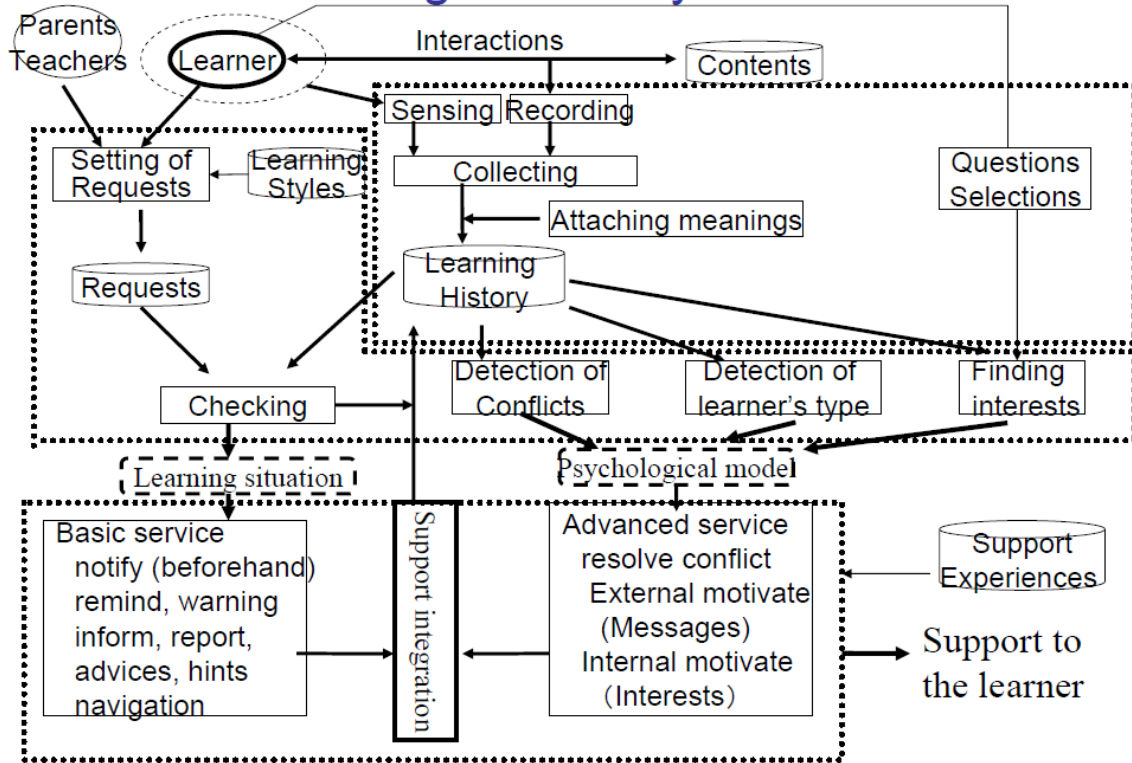
Behavior Analysis and Management

1. ABC based behavior Analysis and management
   - ABC: Antecedent, Behavior, Consequence
     - In a predefined time, learning, getting points
2. Principle of Reinforcement (Punishment)
   - The same actions will be increased (decreased),
     if reinforcer (punisher) is given to the learner,
     after the learner performs a learning action.
3. Principle of Discrimination
   - Actions will be increased (decreased) by reinforced
     (punished) antecedents.
4. Principle of shaping
   - Shaping is a changing process of performance of
     behavior from initial level to higher level.
   - Successive steps to approximate to the goal
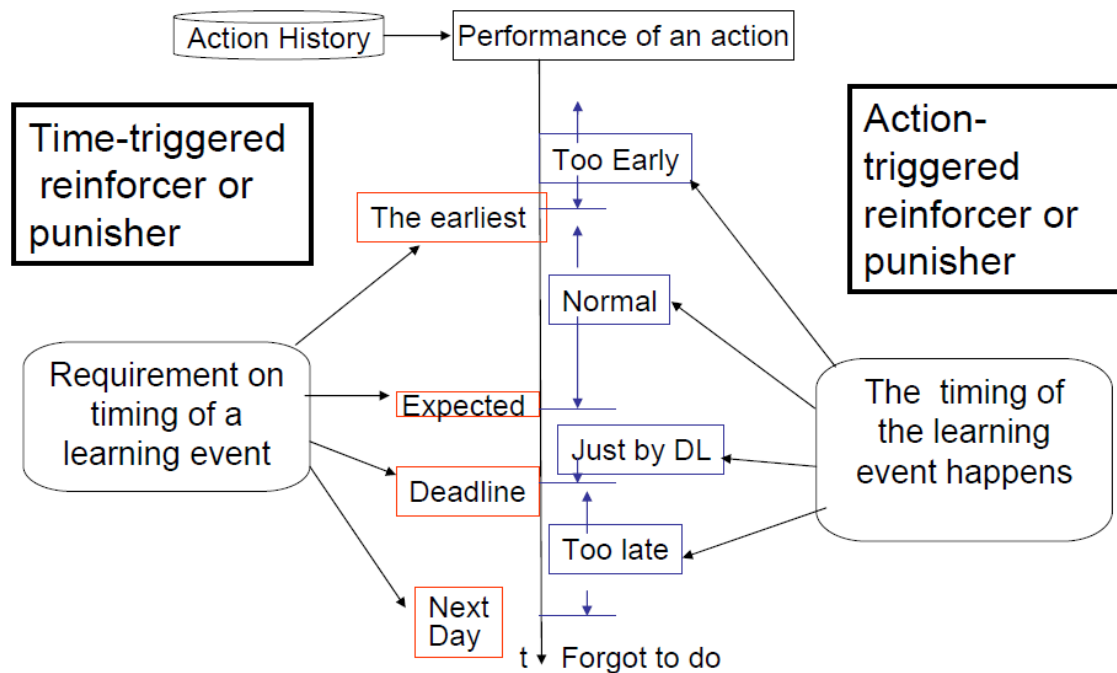   - Ratio of reinforcement to punishment should be high
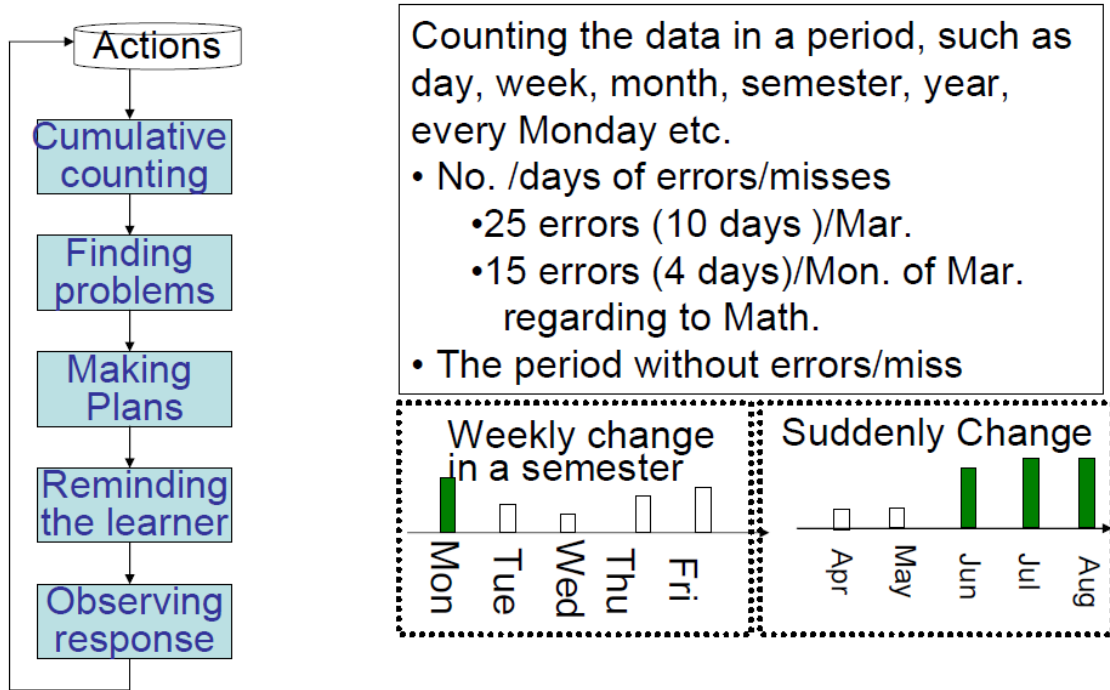
Design of the System
(U-Learning Environment)

Control
Present
Collect
Check
Analyze
Decide

Contents
Learner
Request
Support

Sensors

Place(room)

Design of the System

Parents Teachers

Learner

Interactions → Contents

Sensing | Recording

Setting of Requests ← Learning Styles

Collecting

Attaching meanings

Questions Selections

Requests

Learning History

Checking → Detection of Conflicts · Detection of learner's type · Finding interests

Learning situation

Psychological model

Basic service
notify (beforehand)
remind, warning
inform, report,
advices, hints
navigation

Support integration

Advanced service
resolve conflict
External motivate
(Messages)
Internal motivate
(Interests)

Support Experiences

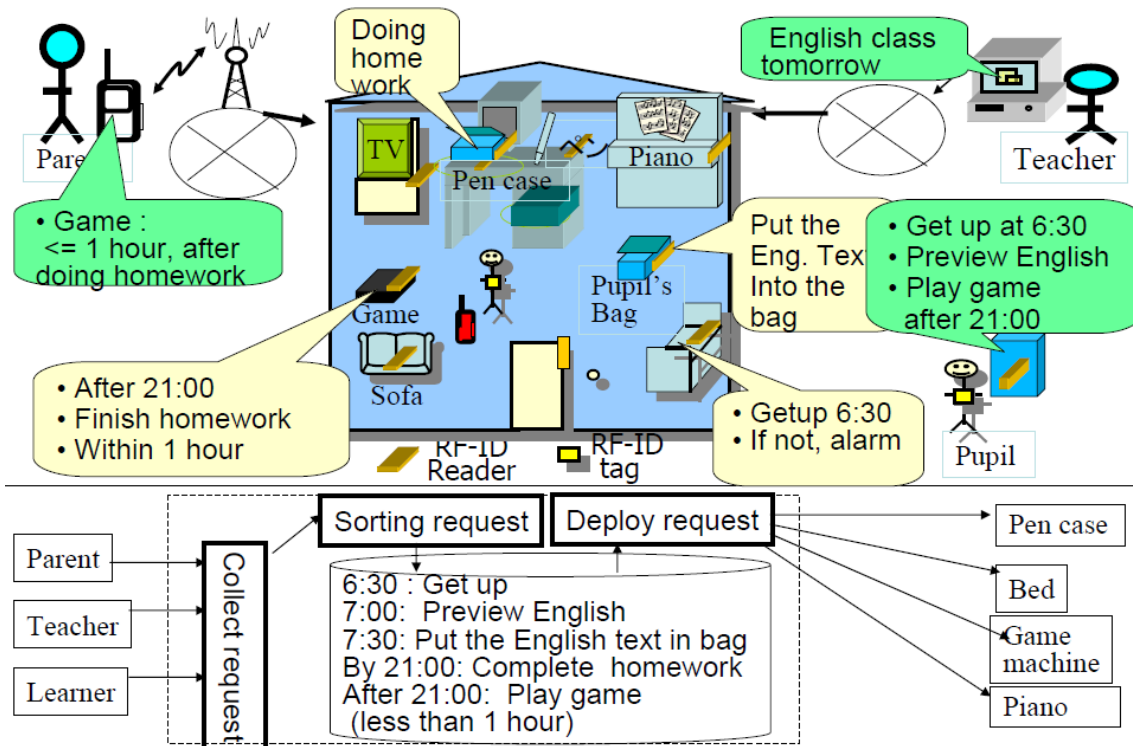Support to the learner

Design of the System
(Time-trigger and action-trigger support)

Action History → Performance of an action

Time-triggered reinforcer or punisher

Action-triggered reinforcer or punisher

Too Early

The earliest

Normal

Requirement on timing of a learning event

Expected

Just by DL

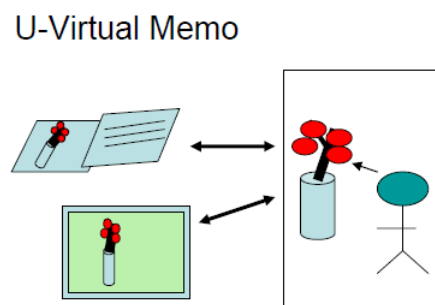The timing of the learning event happens

Deadline

Too late

Next Day

t ↓ Forgot to do

Design of the System
(Method for Behavior Management)

Actions

Cumulative counting

Finding problems

Making Plans

Reminding the learner

Observing response

Counting the data in a period, such as day, week, month, semester, year, every Monday etc.
- No. /days of errors/misses
  - 25 errors (10 days)/Mar.
  - 15 errors (4 days)/Mon. of Mar. regarding to Math.
- The period without errors/miss

Weekly change in a semester

Mon Tue Wed Thu Fri

Suddenly Change

Apr May Jun Jul Aug
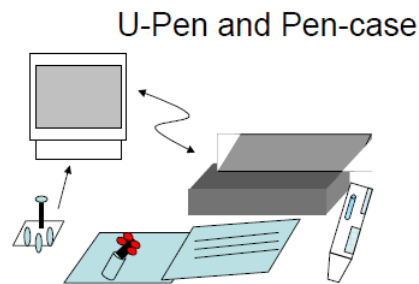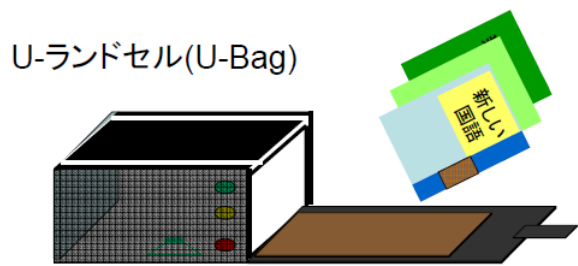
An Application Example (U-Learning Room)

Parent

Doing home work

English class tomorrow

Teacher

TV

Pen case

Piano

- Game : <= 1 hour, after doing homework

Put the Eng. Tex Into the bag

- Get up at 6:30
- Preview English
- Play game after 21:00

Game

Pupil's Bag

- After 21:00
- Finish homework
- Within 1 hour

Sofa

RF-ID Reader

RF-ID tag

- Getup 6:30
- If not, alarm

Pupil

Parent

Teacher

Learner

Collect request

Sorting request

Deploy request

Pen case

6:30 : Get up
7:00: Preview English
7:30: Put the English text in bag
By 21:00: Complete homework
After 21:00: Play game
 (less than 1 hour)

Bed

Game machine

Piano

191

Other Applications (Learning Tools)

U-ランドセル(U-Bag)

U-Pen and Pen-case

U-Learning Table

RF–ID Reader
Reader's range

Learner

NComic
book

Text
book

RP:Shelf

RA:Workspace

RP:Drawer

U-Virtual Memo

Summary

- Ubiquitous Learning becomes a new field
  - Learning from interaction with real things and environment.
  - Learner behavior and psychology can be more correctly grasped
- A new method for grasping personalized learning support
  - Collecting every learner's historic behaviors
  - Comparing them with learning requests and
  - Providing timely suitable supports Grasping every learner's interests, types, and conflict state
  - Providing advance support based on ABC method
- Many possible ubiquitous applications
  - Ubiquitous school bags,
  - Ubiquitous pen and pen-case
  - Ubiquitous learning room
  - …….