Reflection oriented Dependable Planning Concept (RDPC) and its Application to the learning in Education and in Intelligent Agent

Setsuo Tsuruta,
Shinichi Dohi,
Shogo Nakamura
Tokyo Denki University

Background

- Real world, such as learning, is complex, and perfect planning is difficult.
- Problems in its execution and potential capabilities are often found during execution.
- Thus, dependable planning can be defined as such contributes to attain as much as possible.
- It is inherently fault-tolerant, for plans, constrains, or even goals are changed during execution.
- They often seems opportunistically changed but reflection including profound consideration is more important

Need

- Dependable planning needs periodical repetition of plan generation / modification, plan execution, and reflective evaluation.
- Efficient or, at least, serious execution and its evaluation are necessary to attain as much as possible.
- Rather than being opportunistic, planning by reflection such as sufficient consideration about goal and execution results is needed to discover or acquire capability and to cope with encountered problems.
- Computer support for dependable planning is needed, since complex constraints exist in practical planning.
- Orientation to obtain the knowledge for using it seems necessary, since dependable planning is complicate.

Reflection oriented Dependable Planning Concept (RDPC)

- Flexible structure/condition for Planning
  - Flexible conditions such as strict and desirable levels of constraints for planning
- Repetitive planning through stepwise Reflection on evaluation results of the efficient execution
  - Stepwise Reflection and plan modification based on efficient execution & cost/performance evaluation
- Systemization and Orientation
  - Support System: Plan check & simulation tool
  - Orientation/ training to use the system/tool

Concept of Applying RDPC to Education in our school: SIE

- Flexible structure/condition for Planning
  - –No academic year but only Semester, no compulsory subject
  - –Prerequisite and recommended constraints for planning
- Repetitive planning through stepwise Reflection on evaluation results of the efficient execution
  - –Short Class Period (50 minutes class) for Efficient Execution
  - –Quick feedback of Class evaluation for Efficient Execution
  - –Credit System (tuition fee per subject) for Cost Evaluation
  - –GPA (Grade Point Average) for Performance Evaluation
- Systemization and Orientation
  - –Dynamic Syllabus tool (Systemization)
  - –Curriculum Planning class for Training (Orientation)

Quick feedback of class evaluation

(to improve quality of education for efficient learning plan execution)

- **Using the Web, Students can comment and request to the class**
  - **Students are willing to attend classes**
  - **Students can see that other students also do not understand key items, by looking at the Web.**
- **Quick feedback on the class**
  - **Grasp students' understanding level and feedback**

Credit System

(Reminding students of the course price for efficient learning plan execution)

- **One unit = \15,700**
  - **Around 60k\ tuition fee per subject (4 units course)**
- **Effects**
  - **Few students drop (give up) courses**

GPA (Grade Point Average:

for efficient learning plan execution)

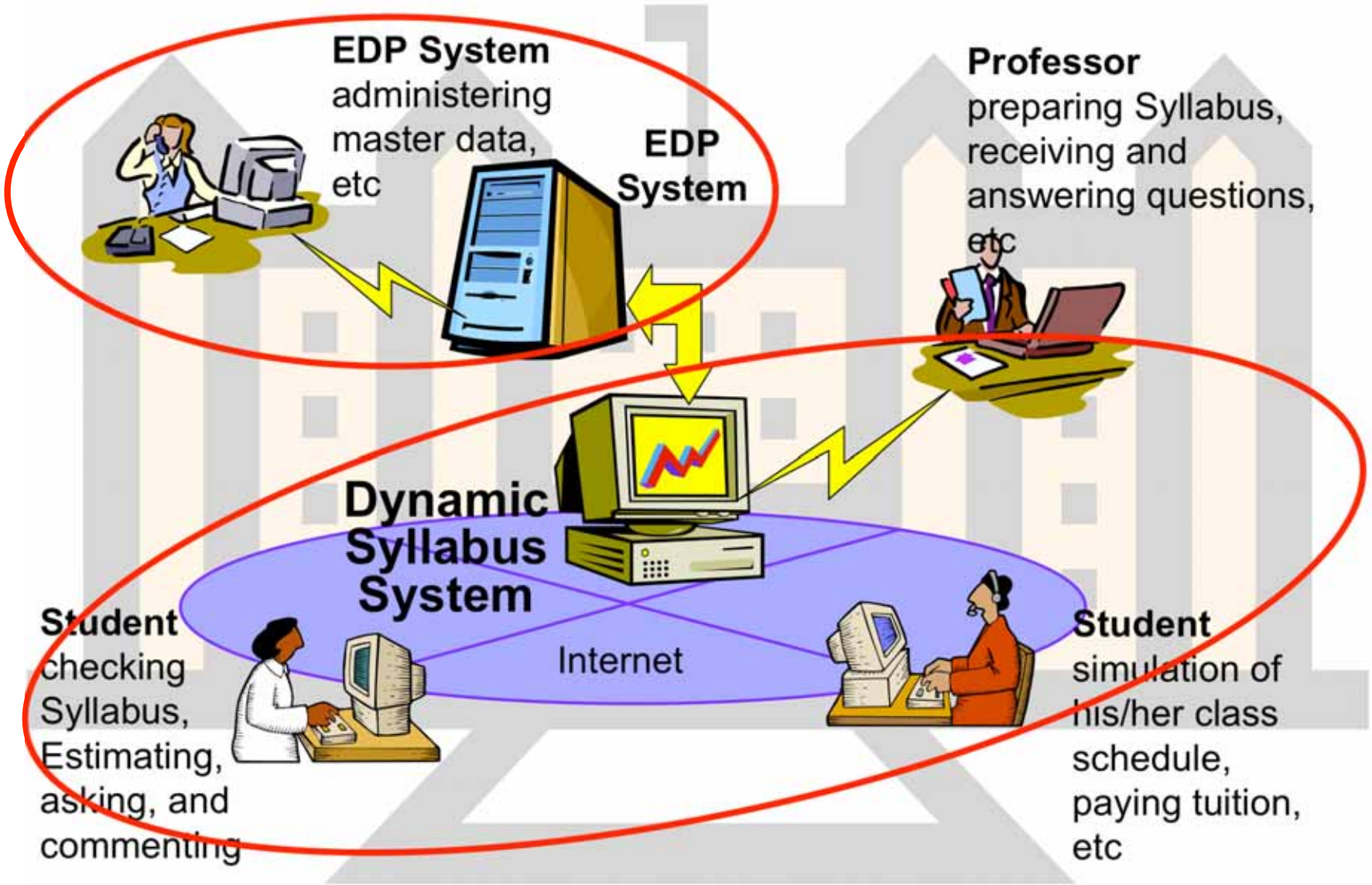
$$GPA = \frac{\sum_{i=1}^{n} u_i g_i}{\sum_{i=1}^{n} r_i}$$

Units of each course (u)
Grade point acquired for each course (g)

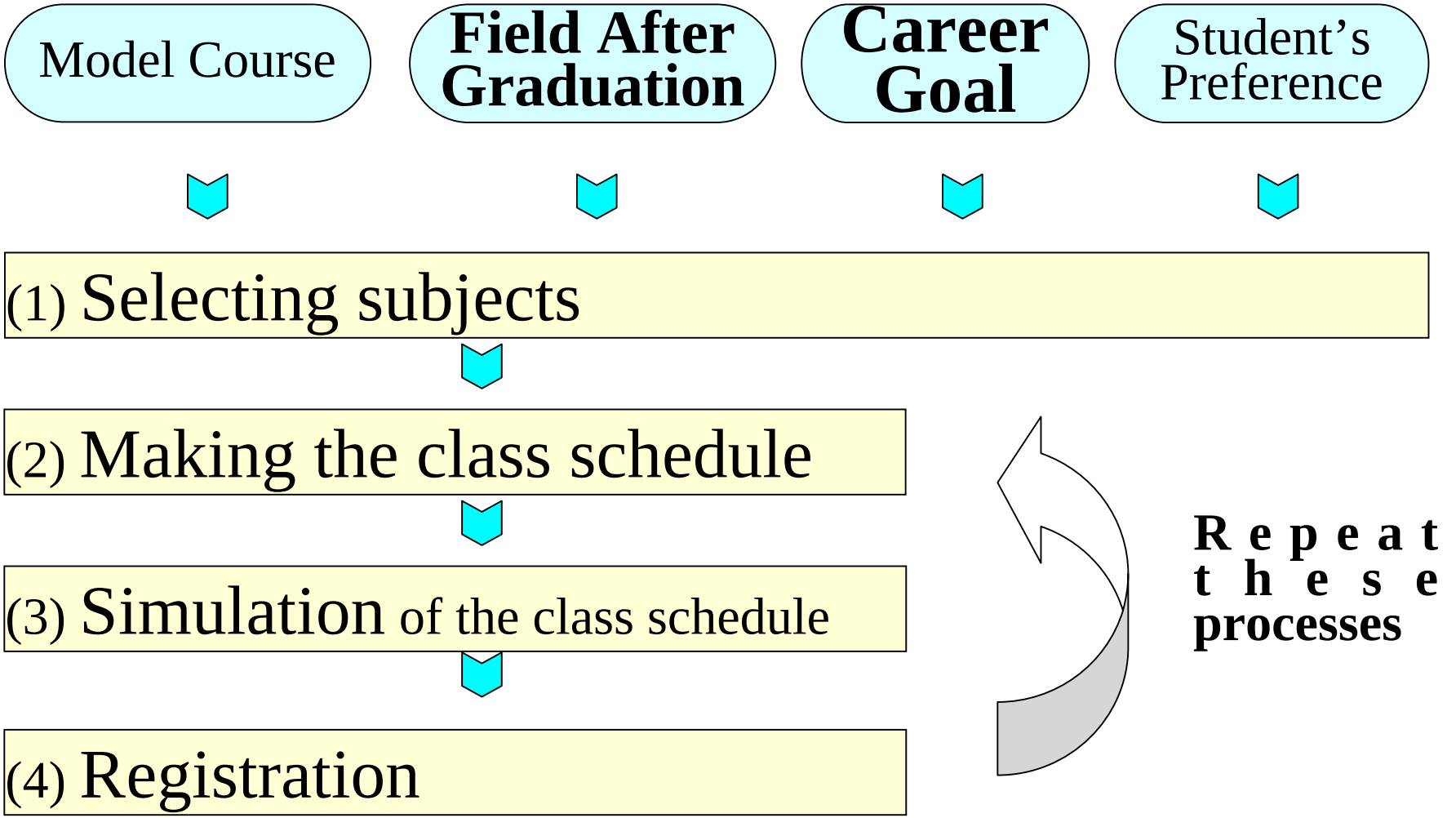
Units of registration (r)

Rank(Score)	Grade Point
S(90 –)	4
A(80 – 89)	4
B(70 – 79)	3
C(60 – 69)	2
D(40 – 59)	0
E(– 39)	0

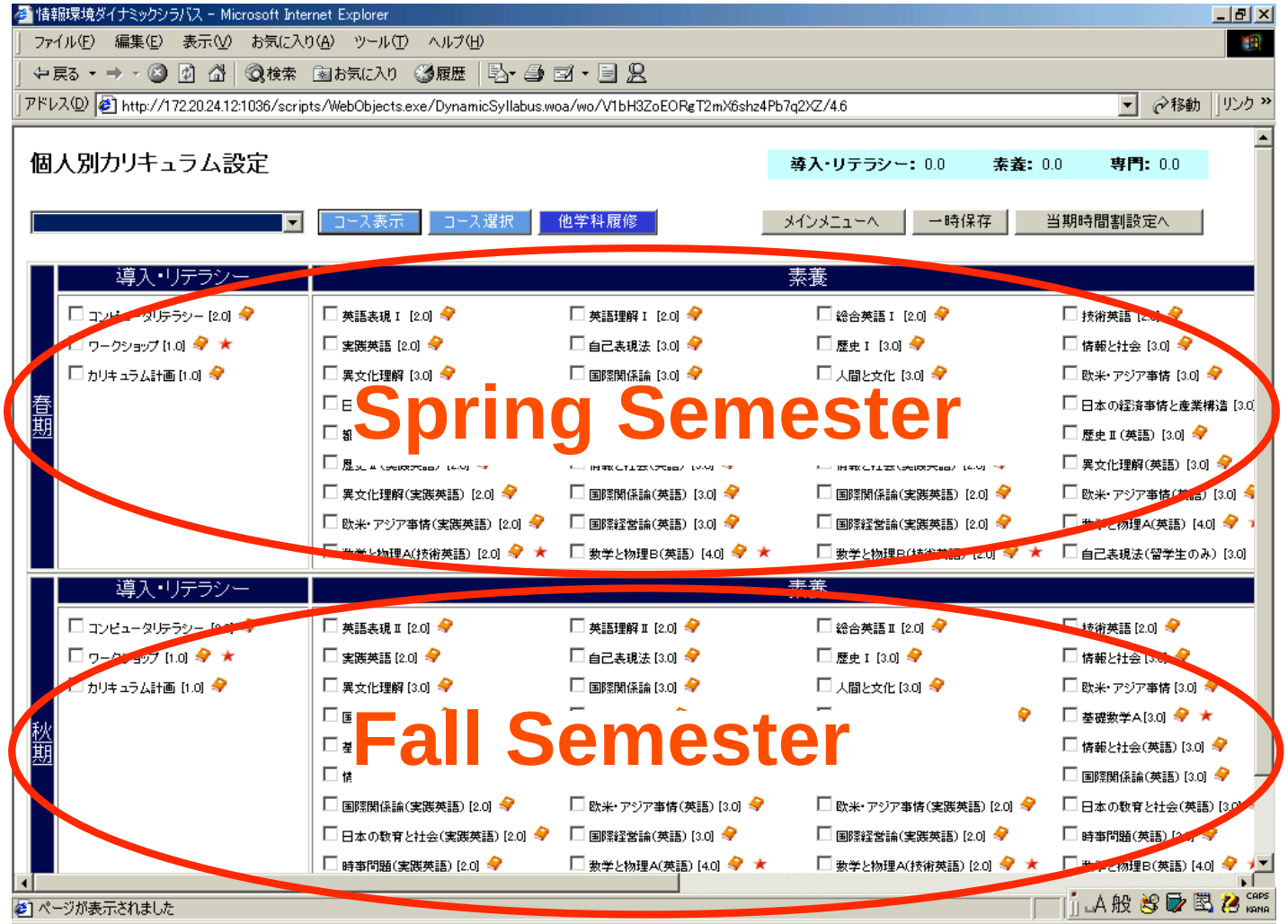
Conceptual Architecture of Dynamic Syllabus (DS) tool for RDPC



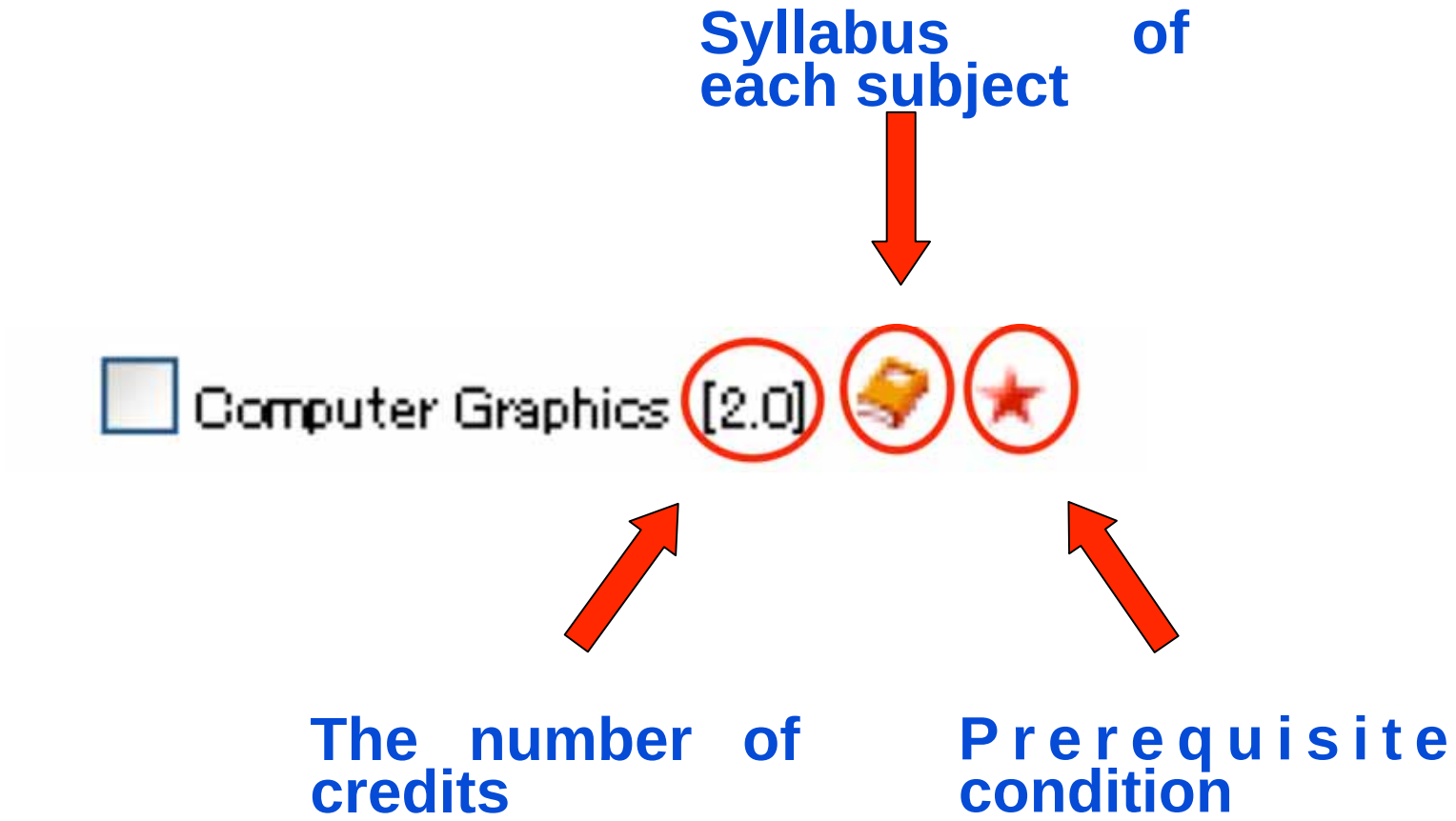
Process of planning Student's own curriculum (class schedule)



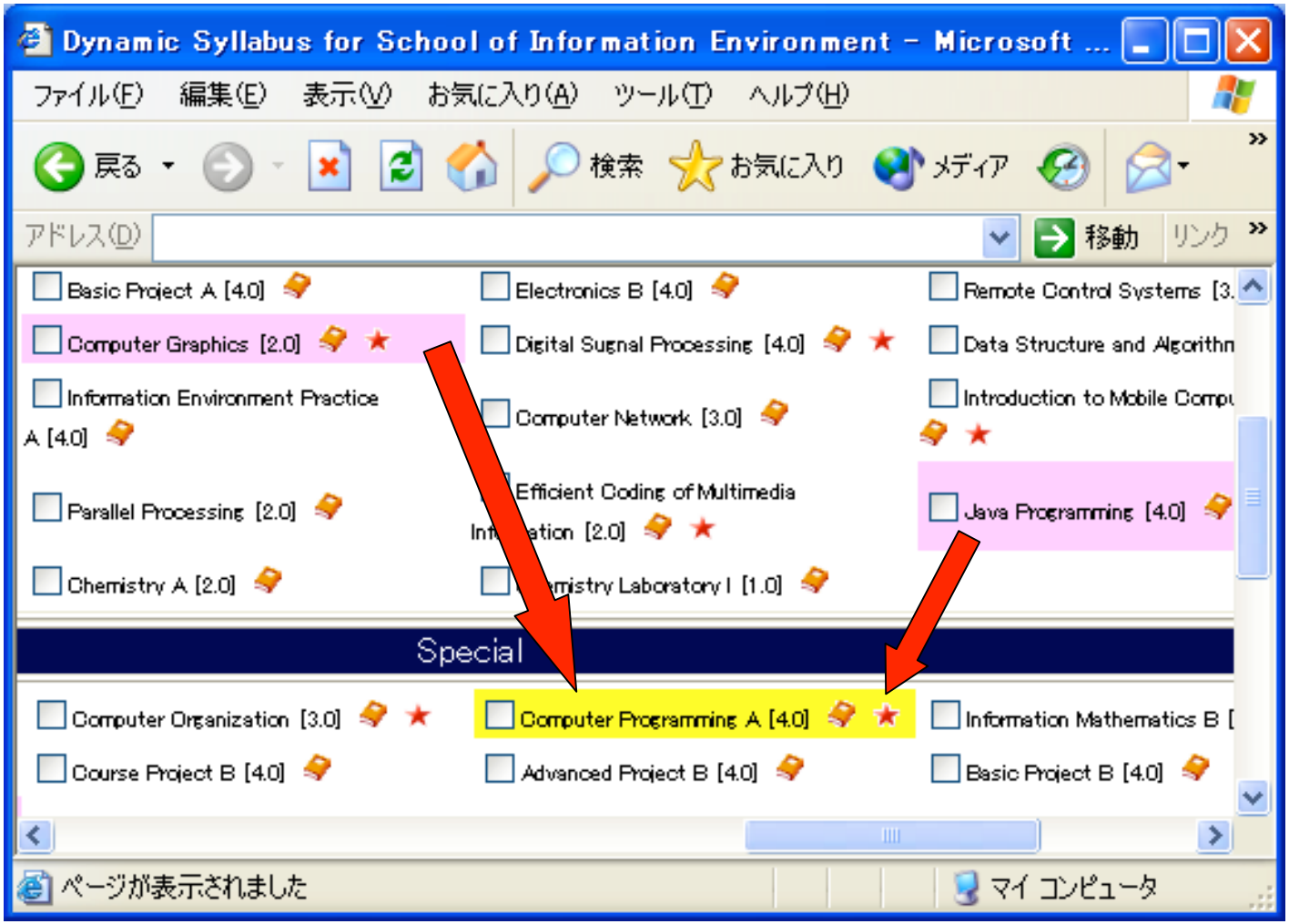
Curriculum set-up window



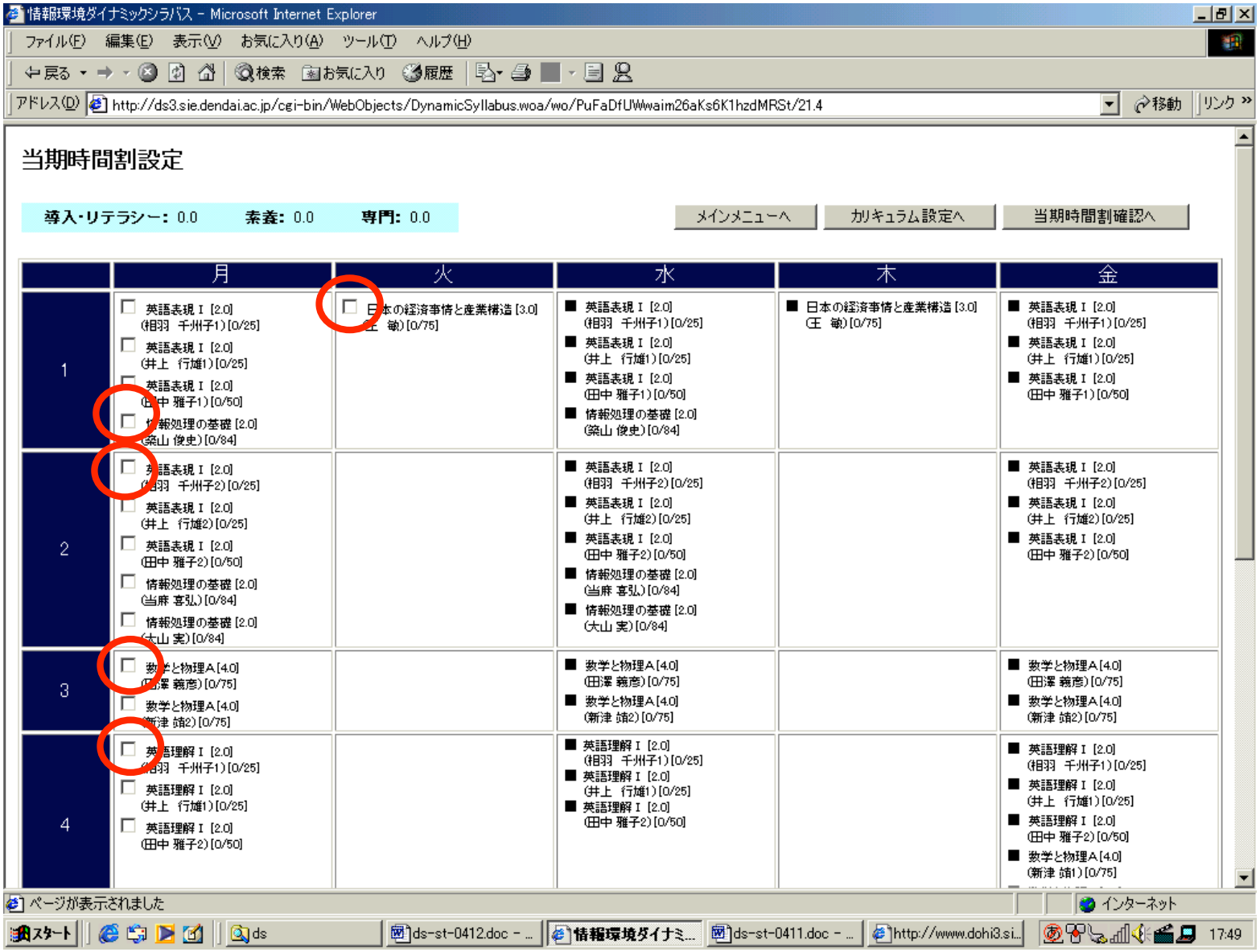
Information of each subject



Prerequisite Condition



Prototype of Class Schedule



Completion of Class Schedule

Effects of RDPC on dependable planning in Practical Education

- Effects of stepwise Reflection on evaluation results of the efficient execution
  - Effects of GPA and Credit System (50% dropped)
  - Effects of Short Class Period (30 % vs. 5 % failed in Exam.)
- Effects of Systemization and Orientation
  - 93.6 % created 4 years curriculum plan using DS tool/system
  - 80 % felt Training (Orientation) in Curriculum Planning Class is useful to learn how to use DS tool.

Applicability to intelligent agents (1)

- Using simulation system such as DS of RDPC, software agents can also create their learning plans, as follows.
  - Software agents should be trained how to use RDPC system (training).
  - Learning goals such as academic goals should be given.
  - Applications of learning subjects have to be derived from system functions which should be assisted by intelligent system assistants.
  - Evaluation method including grading points such as GPA and evaluation timing such a semester are also necessary.
  - All subjects should have the same evaluation timing to synchronously modify the learning plan, since they relate each other by prerequisite conditions and so on.
  - Each evaluation, the learning plans can be modified at each step, reflecting capabilities or various difficulties encountered while learning.
- Thus, they can learn efficiently and dependably towards their learning goal or attain as much as possible.

Applicability to intelligent agents (2)

- The more agents become intelligent, the more they become alike human. And they become sometimes too lazy to search, achieve, or satisfy a reasonable but hard goal or high level need.
- Application to education teaches the following.

"Through introducing severe but reasonable evaluation system e.g. GPA and a credit system, machine agents also are expected to be controlled as human lest they should be lazy or give up when they try to achieve or satisfy a difficult goal, sub-goal or need for learning."

Applicability to intelligent agents (3)

- As to the learning goal, the DS tool for RDPC is restricted to the academic goal or the school age.
- Meanwhile, software agents should learn as long as they live or they are needed as intelligent system assistants.
- This is a kind of life learning in case of human.
- However, as to the application for intelligent software agents, it is also reasonable to have a restriction that the new learning subjects (new intelligent functions) do not appear in the same version/revision of software agents.
- Thus, the structure or order for learning subjects is fixed concerning such as prerequisite/desired conditions.

Applicability to intelligent agents (4)

- If system functions increase in case of version-up, software agents will be given a new academic goal or a new system concept.
- Deriving a set of applicant learning subjects from added or modified functions of the new version, RDPC is possibly used as in an academic education.

Introduction of Story-board

- Though partly fixed or implicitly incorporated, concrete learning or didactic knowledge used in the practical education is in DS.
- Really, such knowledge is used in the practical education to exploit RDPC in the education (Curriculum Planning) of our school SIE.
- Story-board has no such concrete knowledge in its framework.
  - However it can represent concrete knowledge .
  - It is more general knowledge representation framework.
- Thus, in order to build a dependable planning system for intelligent agents' learning, Story-board is useful if the practically used learning (meta) knowledge such as those in DS of RDPC or more especially for software agents' learning is incorporated.

Conclusion

1. RDPC helped by its DS tool and training of its usage was proved effective to its application in education, namely in dependable curriculum planning by each students of our school SIE.
2. Furthermore, RDPC was found applicable to the learning of intelligent machine agents, especially through incorporating its conceptual or meta knowledge to general representation tool such as a story board