

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

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# 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, constraints, 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)

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

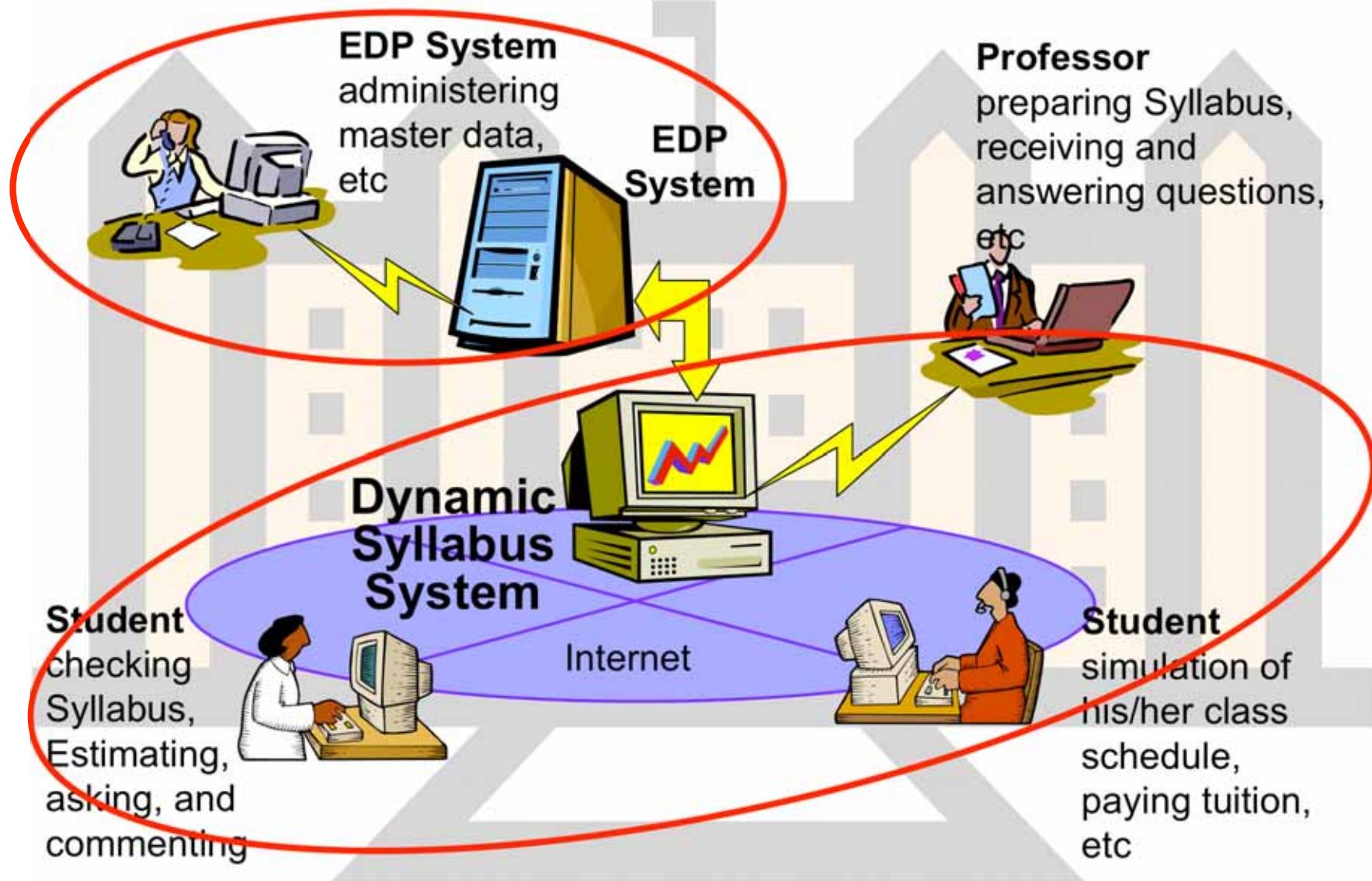
Units of each course ( $u$ )  
Grade point acquired for each course ( $g$ )

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





# Curriculum set-up window

The screenshot shows a web browser window titled "情報環境ダイナミックシラバス - Microsoft Internet Explorer". The address bar shows the URL: <http://172.20.24.121036/scripts/WebObjects.exe/DynamicSyllabus.woa/wo/V1bH3ZoEORgT2mX6shz4Pb7q2XZ/4.6>. The page title is "個人別カリキュラム設定".

At the top right, there are three status indicators: "導入・リテラシー: 0.0", "素養: 0.0", and "専門: 0.0". Below these are buttons for "コース表示", "コース選択", "他学科履修", "メインメニューへ", "一時保存", and "当期時間割設定へ".

The main content is divided into two sections: "Spring Semester" (春期) and "Fall Semester" (秋期). Each section has a table of course options with checkboxes and credit values.

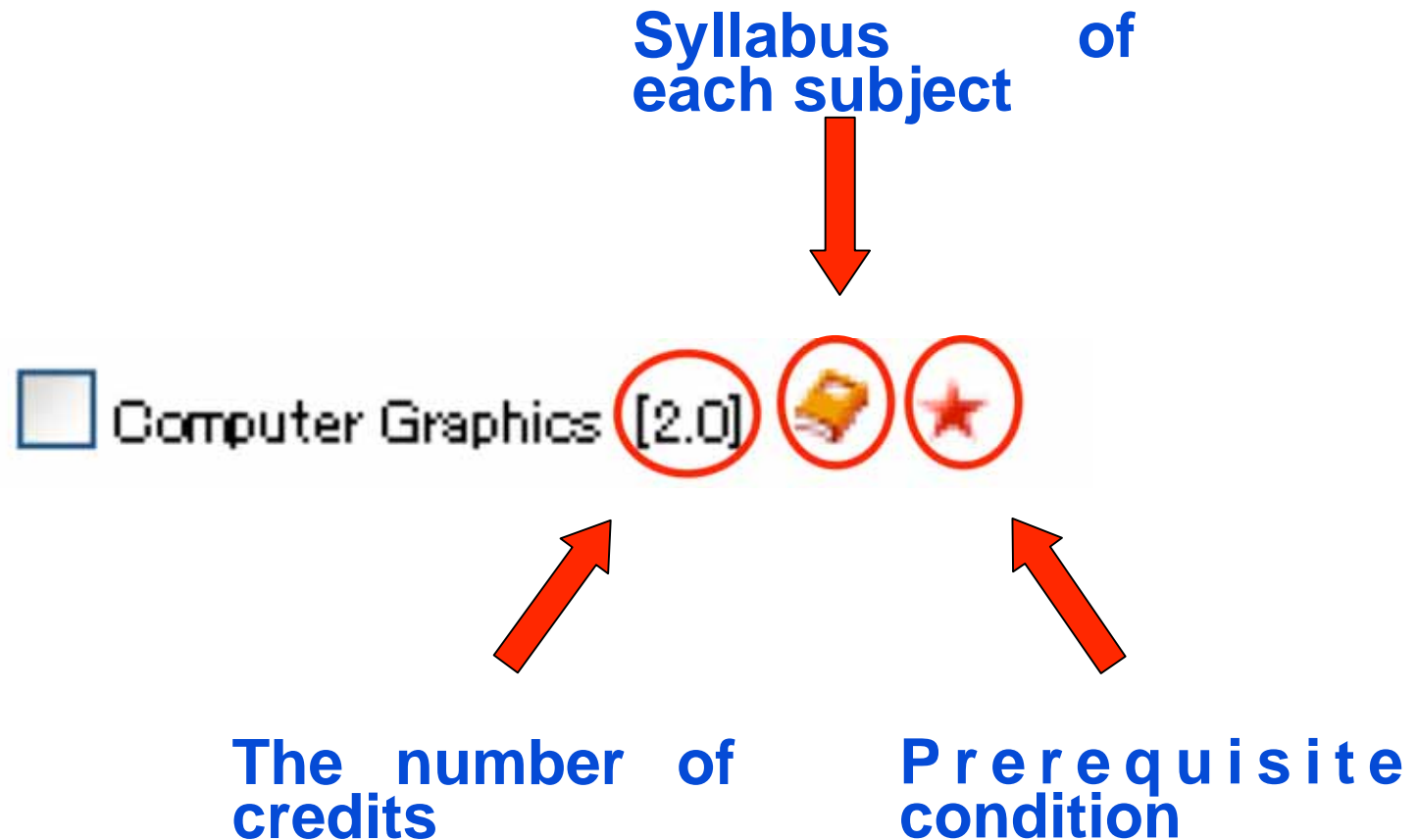
導入・リテラシー	素養			
<input type="checkbox"/> コンピュータリテラシー [2.0]	<input type="checkbox"/> 英語表現 I [2.0]	<input type="checkbox"/> 英語理解 I [2.0]	<input type="checkbox"/> 総合英語 I [2.0]	<input type="checkbox"/> 技術英語 [2.0]
<input type="checkbox"/> ワークショップ [1.0]	<input type="checkbox"/> 実践英語 [2.0]	<input type="checkbox"/> 自己表現法 [3.0]	<input type="checkbox"/> 歴史 I [3.0]	<input type="checkbox"/> 情報と社会 [3.0]
<input type="checkbox"/> カリキュラム計画 [1.0]	<input type="checkbox"/> 異文化理解 [3.0]	<input type="checkbox"/> 国際関係論 [3.0]	<input type="checkbox"/> 人間と文化 [3.0]	<input type="checkbox"/> 欧米・アジア事情 [3.0]
	<input type="checkbox"/> 異文化理解(実践英語) [2.0]	<input type="checkbox"/> 国際関係論(英語) [3.0]	<input type="checkbox"/> 国際関係論(実践英語) [2.0]	<input type="checkbox"/> 日本の経済事情と産業構造 [3.0]
	<input type="checkbox"/> 欧米・アジア事情(実践英語) [2.0]	<input type="checkbox"/> 国際経営論(英語) [3.0]	<input type="checkbox"/> 国際経営論(実践英語) [2.0]	<input type="checkbox"/> 歴史 II (英語) [3.0]
	<input type="checkbox"/> 数学と物理 A(技術英語) [2.0]	<input type="checkbox"/> 数学と物理 B(英語) [4.0]	<input type="checkbox"/> 数学と物理 B(技術英語) [2.0]	<input type="checkbox"/> 異文化理解(英語) [3.0]

導入・リテラシー	素養			
<input type="checkbox"/> コンピュータリテラシー [2.0]	<input type="checkbox"/> 英語表現 II [2.0]	<input type="checkbox"/> 英語理解 II [2.0]	<input type="checkbox"/> 総合英語 II [2.0]	<input type="checkbox"/> 技術英語 [2.0]
<input type="checkbox"/> ワークショップ [1.0]	<input type="checkbox"/> 実践英語 [2.0]	<input type="checkbox"/> 自己表現法 [3.0]	<input type="checkbox"/> 歴史 I [3.0]	<input type="checkbox"/> 情報と社会 [3.0]
<input type="checkbox"/> カリキュラム計画 [1.0]	<input type="checkbox"/> 異文化理解 [3.0]	<input type="checkbox"/> 国際関係論 [3.0]	<input type="checkbox"/> 人間と文化 [3.0]	<input type="checkbox"/> 欧米・アジア事情 [3.0]
	<input type="checkbox"/> 国際関係論(実践英語) [2.0]	<input type="checkbox"/> 欧米・アジア事情(英語) [3.0]	<input type="checkbox"/> 欧米・アジア事情(実践英語) [2.0]	<input type="checkbox"/> 基礎数学 A [3.0]
	<input type="checkbox"/> 日本の教育と社会(実践英語) [2.0]	<input type="checkbox"/> 国際経営論(英語) [3.0]	<input type="checkbox"/> 国際経営論(実践英語) [2.0]	<input type="checkbox"/> 情報と社会(英語) [3.0]
	<input type="checkbox"/> 時事問題(実践英語) [2.0]	<input type="checkbox"/> 数学と物理 A(英語) [4.0]	<input type="checkbox"/> 数学と物理 A(技術英語) [2.0]	<input type="checkbox"/> 国際関係論(英語) [3.0]

At the bottom, there is a status bar that says "ページが表示されました".

# Information of each subject



# Prerequisite Condition

The screenshot shows a web browser window titled "Dynamic Syllabus for School of Information Environment - Microsoft ...". The browser interface is in Japanese, with a menu bar containing "ファイル(E)", "編集(E)", "表示(V)", "お気に入り(A)", "ツール(T)", and "ヘルプ(H)". The address bar is empty. The main content area displays a list of courses, each with a checkbox, a course name, and a credit value in brackets. The courses are arranged in a grid. Two red arrows point to specific courses: one points to "Computer Graphics [2.0]" (highlighted in pink) and another points to "Computer Programming A [4.0]" (highlighted in yellow). The "Special" section is also visible, containing "Computer Organization [3.0]" and "Advanced Project B [4.0]". The status bar at the bottom shows "ページが表示されました" and "マイ コンピュータ".

Course Name	Credits	Star
Basic Project A	[4.0]	
Computer Graphics	[2.0]	★
Information Environment Practice A	[4.0]	
Parallel Processing	[2.0]	
Chemistry A	[2.0]	
Electronics B	[4.0]	
Digital Signal Processing	[4.0]	★
Computer Network	[3.0]	
Efficient Coding of Multimedia Information	[2.0]	★
Chemistry Laboratory I	[1.0]	
Remote Control Systems	[3.0]	
Data Structure and Algorithm		
Introduction to Mobile Computing		★
Java Programming	[4.0]	
Computer Organization	[3.0]	★
Computer Programming A	[4.0]	★
Information Mathematics B		
Course Project B	[4.0]	
Advanced Project B	[4.0]	
Basic Project B	[4.0]	

# Prototype of Class Schedule

情報環境ダイナミックシラバス - Microsoft Internet Explorer

ファイル(F) 編集(E) 表示(V) お気に入り(A) ツール(T) ヘルプ(H)

アドレス(D) http://ds3.sie.dendai.ac.jp/cgi-bin/WebObjects/DynamicSyllabus.woa/wo/PuFaDfUWwaim26aKs6K1hzdMRSt/21.4

## 当期時間割設定

導入・リテラシー: 0.0    素養: 0.0    専門: 0.0

メインメニューへ    カリキュラム設定へ    当期時間割確認へ

	月	火	水	木	金
1	<input type="checkbox"/> 英語表現 I [2.0] (相羽 千州子1) [0/25] <input type="checkbox"/> 英語表現 I [2.0] (井上 行雄1) [0/25] <input type="checkbox"/> 英語表現 I [2.0] (田中 雅子1) [0/50] <input type="checkbox"/> 情報処理の基礎 [2.0] (築山 俊史) [0/84]	<input type="checkbox"/> 日本の経済事情と産業構造 [3.0] (佐 敏) [0/75]	<input checked="" type="checkbox"/> 英語表現 I [2.0] (相羽 千州子1) [0/25] <input checked="" type="checkbox"/> 英語表現 I [2.0] (井上 行雄1) [0/25] <input checked="" type="checkbox"/> 英語表現 I [2.0] (田中 雅子1) [0/50] <input checked="" type="checkbox"/> 情報処理の基礎 [2.0] (築山 俊史) [0/84]	<input checked="" type="checkbox"/> 日本の経済事情と産業構造 [3.0] (佐 敏) [0/75]	<input checked="" type="checkbox"/> 英語表現 I [2.0] (相羽 千州子1) [0/25] <input checked="" type="checkbox"/> 英語表現 I [2.0] (井上 行雄1) [0/25] <input checked="" type="checkbox"/> 英語表現 I [2.0] (田中 雅子1) [0/50]
2	<input type="checkbox"/> 英語表現 I [2.0] (相羽 千州子2) [0/25] <input type="checkbox"/> 英語表現 I [2.0] (井上 行雄2) [0/25] <input type="checkbox"/> 英語表現 I [2.0] (田中 雅子2) [0/50] <input type="checkbox"/> 情報処理の基礎 [2.0] (当麻 喜弘) [0/84] <input type="checkbox"/> 情報処理の基礎 [2.0] (大山 実) [0/84]		<input checked="" type="checkbox"/> 英語表現 I [2.0] (相羽 千州子2) [0/25] <input checked="" type="checkbox"/> 英語表現 I [2.0] (井上 行雄2) [0/25] <input checked="" type="checkbox"/> 英語表現 I [2.0] (田中 雅子2) [0/50] <input checked="" type="checkbox"/> 情報処理の基礎 [2.0] (当麻 喜弘) [0/84] <input checked="" type="checkbox"/> 情報処理の基礎 [2.0] (大山 実) [0/84]		<input checked="" type="checkbox"/> 英語表現 I [2.0] (相羽 千州子2) [0/25] <input checked="" type="checkbox"/> 英語表現 I [2.0] (井上 行雄2) [0/25] <input checked="" type="checkbox"/> 英語表現 I [2.0] (田中 雅子2) [0/50]
3	<input type="checkbox"/> 数学と物理A [4.0] (田澤 義彦) [0/75] <input type="checkbox"/> 数学と物理A [4.0] (新津 靖2) [0/75]		<input checked="" type="checkbox"/> 数学と物理A [4.0] (田澤 義彦) [0/75] <input checked="" type="checkbox"/> 数学と物理A [4.0] (新津 靖2) [0/75]		<input checked="" type="checkbox"/> 数学と物理A [4.0] (田澤 義彦) [0/75] <input checked="" type="checkbox"/> 数学と物理A [4.0] (新津 靖2) [0/75]
4	<input type="checkbox"/> 英語理解 I [2.0] (相羽 千州子1) [0/25] <input type="checkbox"/> 英語理解 I [2.0] (井上 行雄1) [0/25] <input type="checkbox"/> 英語理解 I [2.0] (田中 雅子2) [0/50]		<input checked="" type="checkbox"/> 英語理解 I [2.0] (相羽 千州子1) [0/25] <input checked="" type="checkbox"/> 英語理解 I [2.0] (井上 行雄1) [0/25] <input checked="" type="checkbox"/> 英語理解 I [2.0] (田中 雅子2) [0/50]		<input checked="" type="checkbox"/> 英語理解 I [2.0] (相羽 千州子1) [0/25] <input checked="" type="checkbox"/> 英語理解 I [2.0] (井上 行雄1) [0/25] <input checked="" type="checkbox"/> 英語理解 I [2.0] (田中 雅子2) [0/50] <input checked="" type="checkbox"/> 数学と物理A [4.0] (新津 靖1) [0/75]

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スタート    ds    ds-st-0412.doc - ...    情報環境ダイナ...    ds-st-0411.doc - ...    http://www.dohi3.si...    インターネット    17:49

# Completion of Class Schedule

情報環境ダイナミックシラバス - Microsoft Internet Explorer

ファイル(F) 編集(E) 表示(V) お気に入り(A) ツール(T) ヘルプ(H)

戻る 検索 お気に入り 履歴

アドレス http://ds3.sie.dendai.ac.jp/cgi-bin/WebObjects/DynamicSyllabus.woa/wo/PuFaDfUWwaim26aKs6K1hzdMRS1/172

当期時間割確認 当期時間割設定へ 登録

	月	火	水	木	金
1	情報処理の基礎	日本の経済事情と産業構造	情報処理の基礎	日本の経済事情と産業構造	
2	英語表現 I		英語表現 I		英語表現 I
3	数学と物理A		数学と物理A		数学と物理A
4	英語理解 I		英語理解 I		英語理解 I
5					
6			コンピュータリテラシー		数学と物理A
7			コンピュータリテラシー		
8					

集中 ワークショップ カリキュラム計画

	前期までに履修済みの単位	当期履修する単位	合計/卒業までに必要な単位	当期履修できる単位の上限
導入・リテラシー	0.0	4.0	4.0/2.0	17.0
素養	0.0	11.0	11.0/40.0	
専門	0.0	2.0	2.0/60.0	
合計	0.0	17.0	17.0/124.0	

ページが表示されました インターネット

# 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 like 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

