Knowledge Management Challenges in Web-based Adaptive e-Learning Systems

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Goals

- To introduce to the field of adaptive e-Learning System;
- To consider different dimensions of *knowledge concepts* and organisation of meta-knowledge inside general architecture of adaptive e-learning system;
- To analyze Knowledge Management (KM) Process in adaptive e-Learning System;
- To encourage the initiatives of KM techniques applications into e-Learning Systems;
- To attract attention of KM experts to the problem of adaptation and personalization in e-Learning;
- To emphasize the role of meta-knowledge in adaptive e-learning systems.

Contents

- Short review of recent research on integration of Knowledge Management and e-learning;
- Introduction to Adaptive e-Learning systems;
- General Architecture of adaptive e-Learning System;
- Knowledge in adaptive e-Learning System;
- Knowledge Management Process in Adaptive e-Learning System;
- Discussion and Future Research

Integration of KM and e-Learning

- KM can facilitate an e-learning system [Ravet, 02];
- Same fundamental goal: facilitating organizational learning;
- e-learning system within KM is traditionally analyzed as a knowledge resource repository, where KM methods can be implemented to increase the effectiveness of knowledge dissemination;
- Research is aimed to analyze similarity of goals, methods of assessment, knowledge sharing processes both in KM and e-learning.

Integration of KM and e-Learning

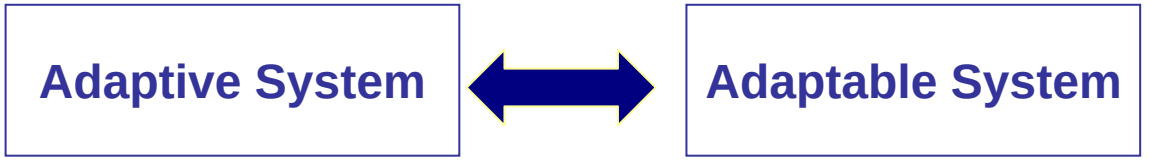
- I-Know' 04, Special Track "Integration of KM and (e)Learning":
  - Issues of knowledge transfer through synchronous e-learning,
  - knowledge sharing instruments and their use for e-learning and work-process oriented environment;
- KM applications that enhance e-learning systems [Ponce, 03]:
  - Content management;
  - Advanced collaboration support;
  - User Profiling;
  - Data Mining;
  - Help-desk.
- Existent research related to adaptive e-learning systems

  discusses KM mainly with respect to content adaptation

Importance of Adaptation in e-learning Systems

- Diversity of users that differ by their knowledge, goals, and preferences;
- The necessity of software personalisation “One size does not fit all!”;
- Different demographical, psychological, and cognitive characteristics of users, behaviour;
- Human factors studies within Human-Computer Interaction;
- Diversity of situation of using the system (consultation, studying, advanced trainingetc)
- Increase the E-learning systems’ efficiency.

Adaptive vs. Adaptable System



Adaptive System : An interactive system that adapts its behavior to individual users on the basis of processes of user model acquisition and application that involve some form of learning, inference, or decision making. (Jameson, 2003).

Adaptable System : The individual user can explicitly tailor to his own preferences.

Adaptive e-Learning System

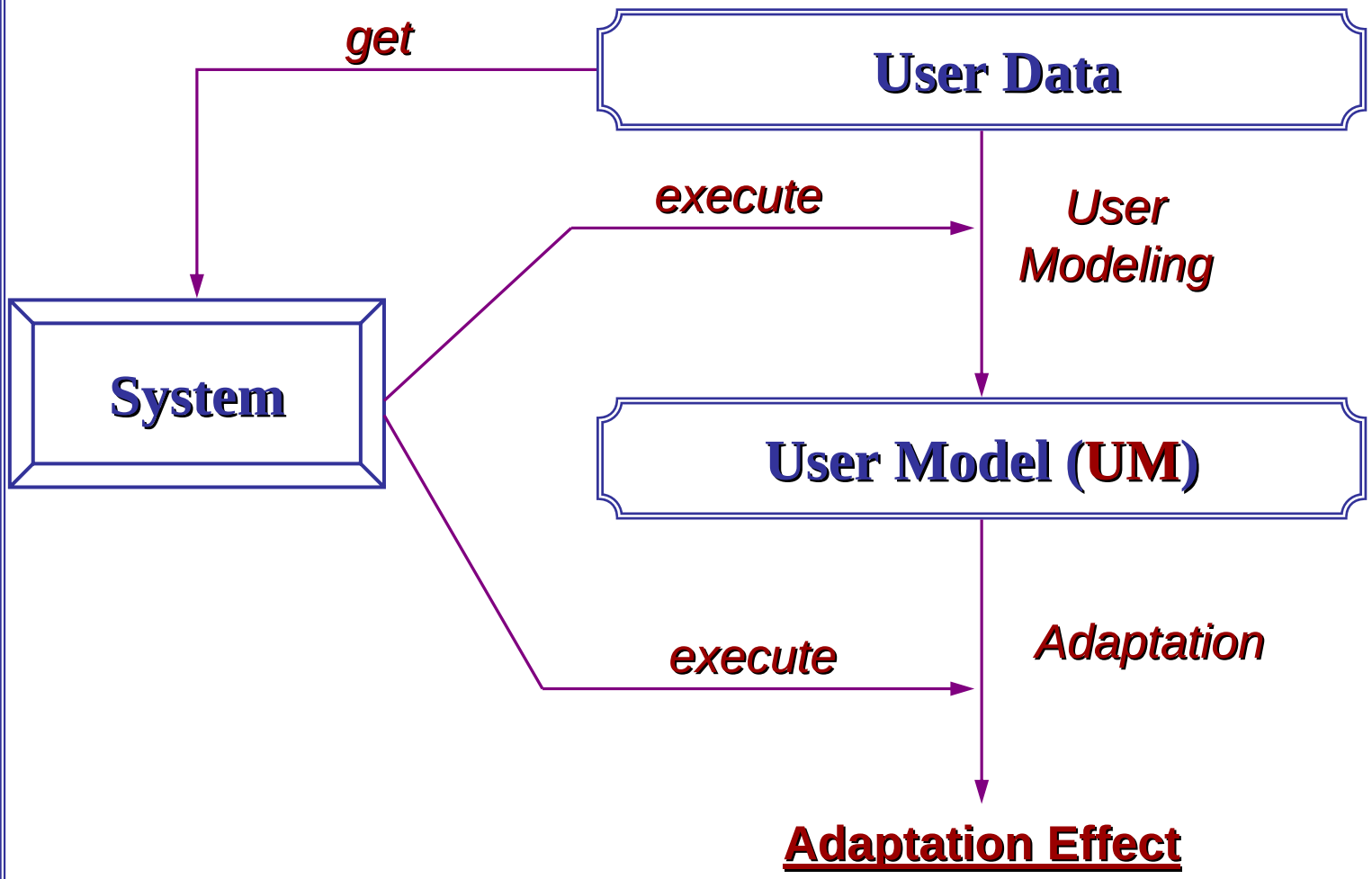
An **e-learning system** is considered to be **adaptive** if it is capable of:

- monitoring the activities of its users;
- interpreting these on the basis of domain-specific models;
- inferring user requirements and preferences out of the interpreted activities, appropriately representing these in associated models; and,
- acting upon the available knowledge on its users and the subject matter at hand, to dynamically facilitate the learning process.

[Paramythis, 04]

- An adaptive e-learning system is ***acting according the meta-knowledge that specifies the context of adaptation***, i.e. how, where, and when the system could be adapted.

Classical Cycle "user modeling-adaptation"



User Model

- **User Model** – is a set of the users main features, which should be taken into account during the choice of the individual human-computer interaction structure [Wagner].

- **User Modelling** - the process of acquiring knowledge about a user in order to provide services or information adapted to their specific requirements [McTear, 1993; Kay, 1995].

Adapt to User's …. (Wade, 2003)

Prior Knowledge & Expertise

Aims and Goals

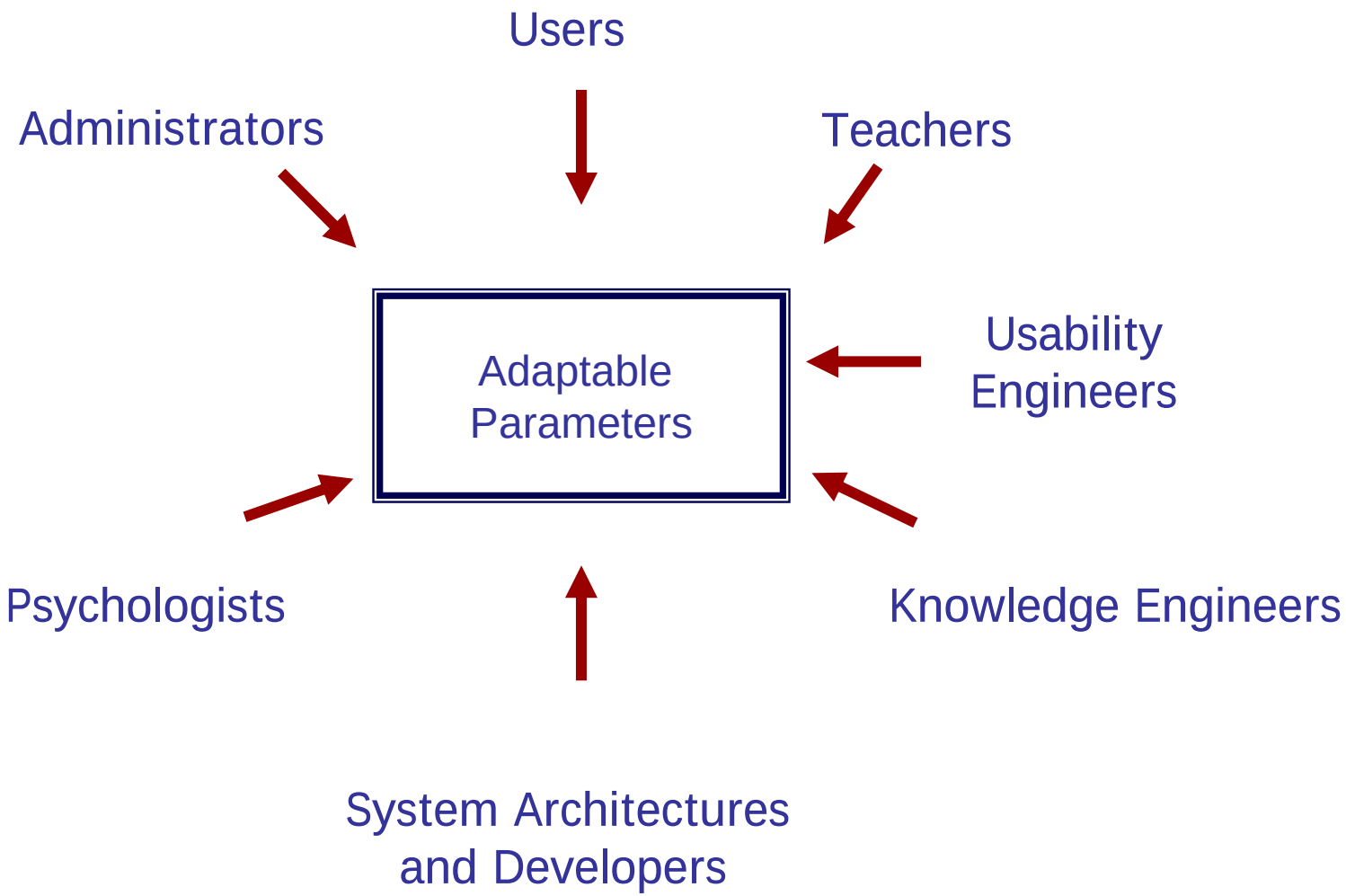
Cognitive & Learning Style

Communication Style & Needs

Preferences & Learning Culture

Learning History

Who define what can should be adapted in e-Learning System?



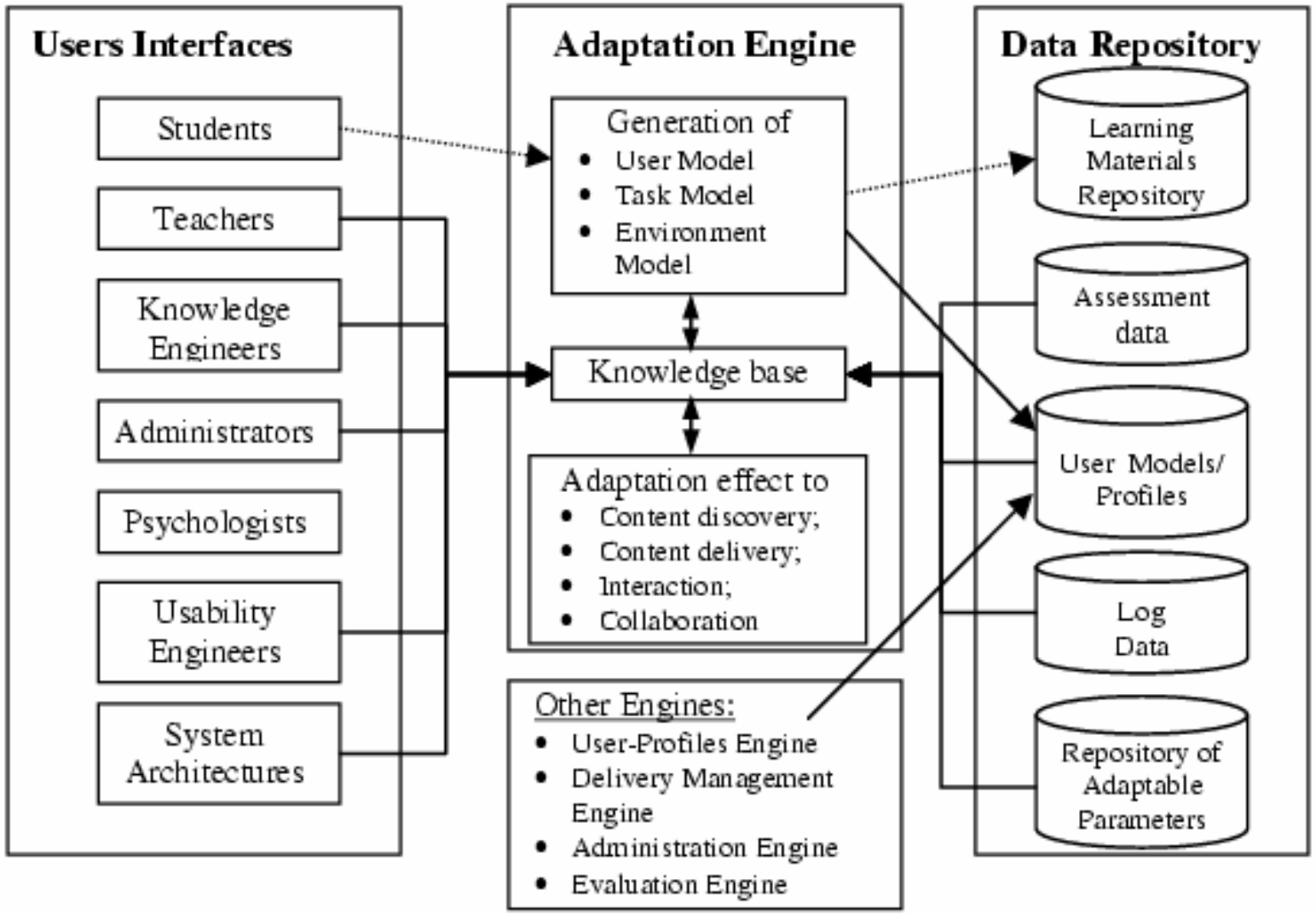
Adaptation Techniques (Brusilovsky, 2002)

- *adaptive content selection* - the system adaptively select and prioritize the most relevant items when the user searches for relevant information,
- *adaptive navigation support* - the system manipulates the links (for example, hide, sort, annotate) during the user navigation session,
- *adaptive presentation system* – system forms layout of a particular page adaptively.

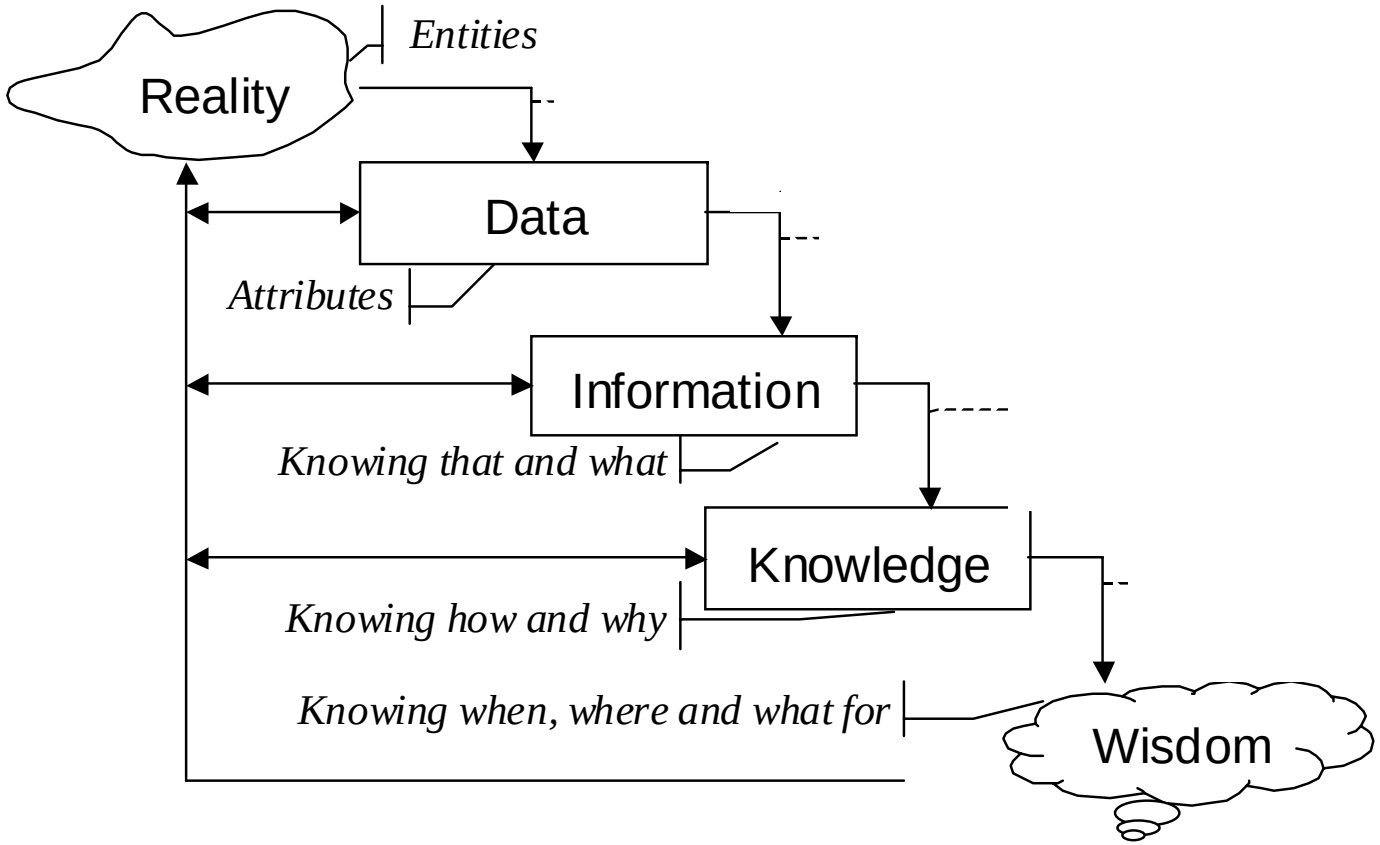
e-Learning system's Adaptation (Paramythis, 2004)

- *Content discovery and assembly* – adaptation discovering and assembling of learning materials;
- *Adaptive course delivery* – tailors learning course to the individual user;
- *Adaptive interaction* – adapts user interface;
- *Adaptive collaboration support* – adaptation of communication used in learning processing.

The General Architecture of Adaptive e-Learning System



Dimensions of Knowledge and their place in KM



(Spiegler, 2000)

Dimensions of Knowledge in (adaptive) e-Learning Systems

Dimensions	Traditional view	Adaptation Context
Data	answers	students data, learning materials
Meta-data	data attributes	profile and model parameters
Information	about e-learning participants, results of assessment	structure of model, profile
Knowledge	learning materials	information on how to present the materials of the learning course to the users.
Meta-knowledge	keywords, material A is part of the course B	knowledge on what (or how) learning materials should be presented to the student with the particular characteristics and what should not be presented

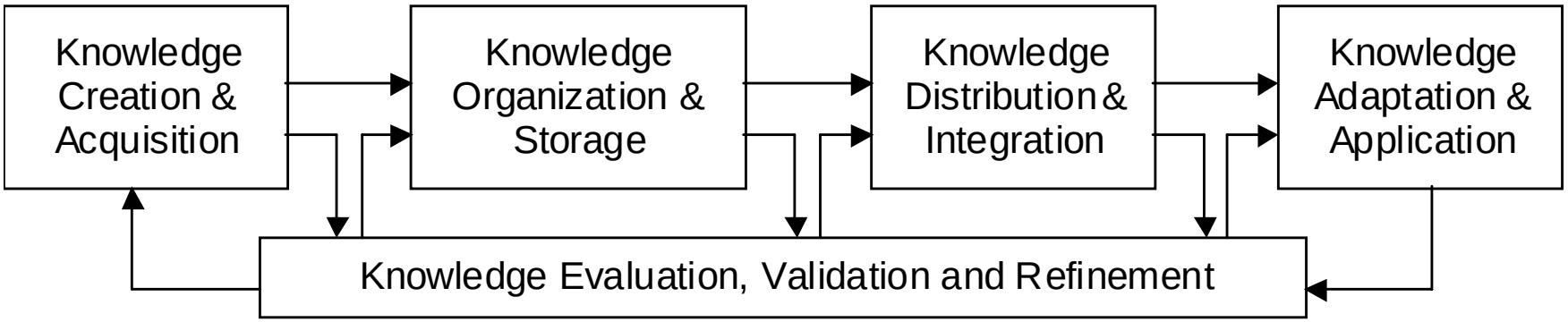
Dimensions of Knowledge (2)

- Knowledge-who;
- Knowledge-why;
- Knowledge-what-for;
- Knowledge-if;
- Knowledge-where;
- Knowledge-when.

e-Learning system's Adaptation

- ***Content discovery and assembly*** – knowledge about users is collected by monitoring and further included in the user models/profiles repository using software tools and meta-knowledge created by the system architects, knowledge engineers, and teachers.
- Meta-knowledge for ***adaptive course delivery*** is mainly acquired from teachers, and usability specialists;
- The role of ***adaptive interaction*** meta-knowledge is to point out the context in which the adaptation should be performed. The meta-knowledge for this type of adaptation is mainly formed on the base of knowledge, which could be acquired from usability specialists, psychologists, and from the experimental studies of the interaction between the user and the system.
- For ***adaptive collaboration support*** the meta-knowledge could be acquired from psychologists, usability engineers, and communication experts.

The Knowledge Management Process



Example: Adaptation of the Learning Materials' Content Presentation according the proficiency of the student in the subject area (Novice/Advanced User).

Knowledge Storage and Re-Use in e-Learning System

In e-learning systems knowledge accumulated with experience could have two main sources:

- It can be accumulated by the system itself, and
- by the participants of the e-learning environment.

Example

Teachers can analyze

- students' performance
- the statistics of students' interaction with the e-learning system (e.g., how long the student has studied certain material, or how many mistakes were made in the test, etc).

Conclusions

- There is necessity of further integration of KM and e-Learning;
- We hope to encourage the initiatives of KM techniques application into e-learning systems and attract attention of KM experts to the problem of adaptation and personalization of e-learning;
- We have suggested the general architecture of adaptive e-Learning system, considered different dimensions of knowledge concepts and the organization of meta-knowledge inside our general architecture;
- We believe that systematic support of meta-knowledge capture and refinement over time would improve e-learning system's adaptation and contribute further research and development of adaptive e-learning systems.

Further Studies

Development of guidelines for adaptive e-learning systems design, addressing the issues of:

- effective meta-knowledge creation, discovery, and acquisition;
- organization and storage;
- evaluation, revision and application for adaptation of content discovery, assembly and delivery;
- user interface and collaboration support.

THANK YOU!

Questions? Comments?

Suggestions?

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