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Ontology implementation within e-Learning Personalization System for Distance Learning in Indonesia

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ABSTRACT

Website is the realization of the internet technology. Nowadays, as seen from the usage trend, the website has evolved. At the beginning, website merely adopts the need for searching and browsing information. The initial step of the raise of this website is often recognized as web 1.0 technology. At present, web 2.0 technology, which enables well web-to-web interaction, has come. Kinds of interaction such as changing information (sharing), in the form of document (slideshare), picture (flickr), or video (youtube), information exploitation (wikipedia), and also online communities creation (weblog, web forum) are principally a service that involve communities (the core of web 2.0). These matters bring impacts caused by the raise of social interactions in virtual world wide (the internet) that is followed by the appearance of learning interaction and training anywhere-anytime which is termed as e-Learning. Basically, online learning requires self-learning method and learning habit, which is –unfortunately- possessed by a few Indonesian human resources. This condition is being worst by the present e-Learning system that focuses merely on the delivery process of the same learning substance content toward the learner, abandon the cognitive aspect and it does not offer approach or an interactive self-learning experience and also abandon the adaptation aspect of user with the system. Therefore, successful e-Learning in Indonesia

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needs e-Learning system that applies web 2.0 technology which urges the learner to actively participate and the system which stresses the personalization such as comprehensive ability, adaptive to levels learner capability and possessing knowledge resources support. Within the constructed e-Learning system, ontology is going to be applied as the representation of meaning of knowledge formed by the learner who uses the system.

Keywords: *e-Learning, personalization e-Learning, adaptive e-Learning, ontology*

ABSTRAK

Website adalah realisasi dari teknologi internet. Saat ini, seperti yang terlihat dari tren penggunaan, situs web telah berevolusi. Pada awalnya, situs hanya mengadopsi kebutuhan untuk mencari dan browsing informasi. Langkah awal peningkatan website sering dikenal sebagai teknologi 1,0 web. Saat ini, teknologi web 2.0 telah memungkinkan interaksi baik antar web-ke-web. Jenis interaksi seperti mengubah informasi (sharing), dalam bentuk dokumen (SlideShare), gambar (flickr), atau video (youtube), informasi eksploitasi (wikipedia), dan juga penciptaan komunitas online (weblog, forum web) terutama layanan yang melibatkan masyarakat (inti dari web 2.0). Hal ini membawa dampak dan disebabkan oleh peningkatan interaksi sosial di dunia maya yang luas (internet) yang diikuti oleh munculnya interaksi pembelajaran dan pelatihan di mana saja-kapan saja yang disebut sebagai e-Learning. Pada dasarnya, belajar online memerlukan metode belajar mandiri dan kebiasaan belajar, yang sayangnya dimiliki oleh beberapa sumber daya manusia Indonesia. Kondisi yang terburuk dengan adanya sistem e-Learning sistem adalah karena e-Learning hanya berfokus pada proses pengiriman konten substansi pembelajaran yang sama terhadap pelajar, meninggalkan aspek kognitif dan tidak menawarkan pendekatan atau pengalaman sendiri belajar interaktif dan juga meninggalkan adaptasi aspek pengguna dengan sistem. Oleh karena itu, agar e-Learning di Indonesia sukses diperlukan sistem e-Learning yang menerapkan teknologi web 2.0 agar para pelajar secara aktif berpartisipasi dan sistem yang menekankan personalisasi seperti kemampuan komprehensif, adaptif untuk tingkat kemampuan pelajar dan pengetahuan yang memiliki dukungan sumber daya. Dalam sistem e-Learning yang dibangun, ontologi akan diterapkan sebagai representasi makna pengetahuan dibentuk oleh para pelajar yang menggunakan sistem.

***Kata kunci**: e-Learning, personalisasi e-Learning, adaptif e-Learning, ontologi*

BACKGROUND

The vast use of internet in the present time by people in developed countries and developing countries like Indonesia has changed the way of living especially in each operational activity. According to Internet World Stat, Indonesian netters reach 20 million up to 2007 and this number is recorded on the list number 14 after Canada. Internet has changed the paradigm of place and distance that is previously seemed far to be nearer. Therefore the use is badly needed in Indonesia that geographically has thousands island.

Web site is the realization of the internet. As seen from the usage trend up to now the web has evolved. At the beginning, website merely adopts the need for searching and browsing information. The initial step of the raise of this website is often recognized as web 1.0 technology. At present, web 2.0 technology, which enables well web-to-web interaction, has come. Kinds of interaction such as changing information (sharing), in the form of document (slideshare), picture (flickr), or video (youtube), information exploitation (wikipedia), and also online communities creation (weblog, web forum) are principally a service that involves communities (the core of web 2.0). These matters bring impacts like the increasing number of social interactions in virtual world wide (the internet) that is followed by the appearance of learning interaction and training anywhere-anytime which is termed as e-Learning.

The development of e-Learning itself has successfully dragged the attention of many parties like industry and education. The existence of e-Learning in industry has increased employees' competency. For instance, Mandiri Bank has launched Learning Management System (LMS) to train about 18 thousand employees spread over 700 branches (Swa Magazine, 2003). To add, CISCO, PT SAP Indonesia, PT Telekomunikasi Indonesia and IBM Indonesia have applied e-learning system to develop their human resources (Sanjay Bharwani, 2004). As well as in education, e-Learning has given the change point of view for teaching-learning process. Based on ASTD (American Society for Training and Development) survey result in 2004, 90% of US Universities have more than 10.000 students who use e-Learning. While in business, the percentage reaches 60% (Ryann Ellis, 2004).

Simply, e-Learning in education is a process of teaching-learning through a computer connected to the internet, which all facilities provided in the learning venue are functionally changeable with certain applications. Learning substances are downloadable, while interaction between teacher and students in the form of assigning tasks can be done intensively in the form of discussion or video conference.

In Indonesia the regulation from government or related department to support the realization of e-Learning for education is implied in Decree no.20 Year 2003 about National Education System clause 31 and the National Education Minister's Decree and Act no. 107/U/2001 about PTJJ, specifically permits education manager in Indonesia to manage education through PTJJ by using IT.

Similar to e-Learning development, vendors of system development appear, starting from open source based system such as Moodle, Dokeos, Sakai etc to proprietary like Blackboard (Web CT). The vast development of open source based system is due to the small amount of e-Learning system investment. The investment includes hardware and software if it is compared to learning conventionally. To mention, several universities in Indonesia and overseas have applied this e-Learning system.

Yet, it is not a guarantee that the increasing number of e-Learning system supports the learning transformation or learning application itself. In 2000, a study held by Forrester Group showed that 68% refused the e-Learning training concept. Meanwhile, the other study indicated that from all registered e-Learning participant 50%-80% did not accomplish the training (Delilo, 2000). It is similar with e-Learning system application in Indonesia. The worst thing is mostly established e-Learning systems are unusable at the end. Basically, online learning requires self-learning method and learning habit, which is –unfortunately- possessed by a few Indonesian human resources only. This condition is being worst by the present e-Learning system that focuses merely on the delivery process of the same learning substance content toward the existing learner, abandon the cognitive aspect and it does not offer approach or an interactive self-learning experience and also abandon the adaptation aspect of user with the system. Therefore, successful e-Learning in Indonesia needs e-Learning system that applies web 2.0 technology which urges the learner to actively participate and supported by the system which stresses on the personalization such as comprehensive ability, adaptive to levels of learner's capability and possessing knowledge resources support.

Online learning that needs self-learning method and habit to learn will be realized into an e-Learning system by using web 2.0 technology (wiki, blog, flickr, and youtube) which focuses on the communities employed service. Content learning will be collected from knowledge resources web 2.0 based in which the metadata is managed using pedagogy ontology.

Ontology, a knowledge representation on a knowledge base that is formed later, is used as a part toward system user in the formed social network. To sum up, e-Learning system that stresses on the personalization such as the ability to accommodate cognitive aspect of the user, understandable and adaptive toward various users -at the end- is capable to increase learner motivation of e-Learning system user.

DISCUSSION

1. e-Learning and Content

Electronic learning or e-Learning is a self-learning process facilitated and supported through the use of ICT [1]. Generally, from the developing e-Learning system nowadays, e-Learning –based on the interactivity- is classified into 2 groups:

a. Static learning. The system user can download the needed learning substance only (content). While the administrator can upload substance files only. The actual learning situation like communication is absent on this system. The system is useful for those who can learn by themselves from readers supplied on the system in the form

of HTML, Power Point, PDF, or video. If it is used, the system can functionally support teaching-learning activities done face-to-face in class.

b. Dynamic learning. The facilities offered are more vary from the first system mentioned. The facilities such as discussion forum, chatting, e-mail, learning evaluation tools, user management and electronic substance management are available. These enable the user (students) to learn in a learning environment that similar to classroom situation. This second system can be used to help transformation process of learning paradigm from teacher-centered to student-centered. It is no longer the instructor who actively delivers the substance or request students to ask about indigestible substance but, here, the students are trained to learn critically and actively. E-Learning system which is developed may use collaborative learning method approach (collaborative learning) or learning from the process of the given problem solving (problem-based learning).

The relation between learning condition and appropriate facilities can be seen in the table below (adopted from Distance Learning and SunMicrosystems [2]) :

	Same Time (Synchronous) (Waktu yang sama)	Different Time (Asynchronous) (Waktu yang berbeda)
Same Place (Tempat yang sama)	Classroom	Learning Center Laboratory Library
Different Place (Tempat yang berbeda)	Audioconferencing Videoconferencing Satellite delivery Chating Room Instrutor-led (Synchronous Learning Systems) Synchronous Streaming	WWW E-Learning Systems Video tape/audio tape CD-ROM Archived Streamed Video Email/Listserv

Picture 1. Perbandingan distance learning

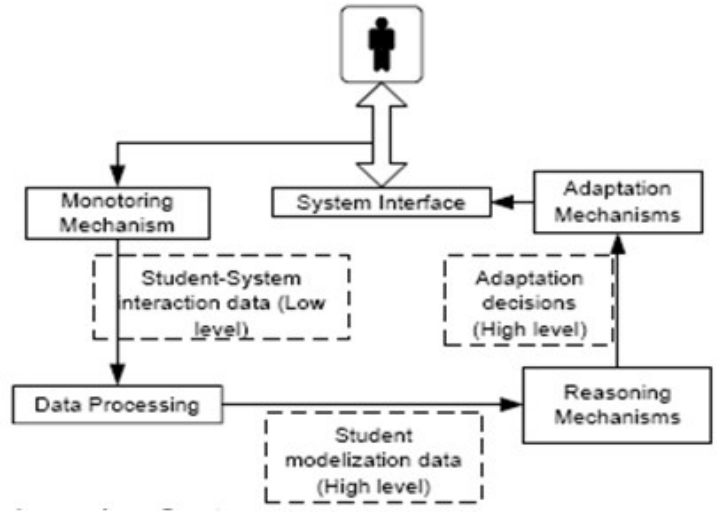
e-Learning content is any digital resources which is used to support learning process. E-Learning content can be categorized into 2 parts:

- *textual,* including text based content like plain-text and PDF
- *non-textual,* including multimedia content such as audio, visual and animation

Textual content can be found easily through search engine (like Google or Yahoo) by typing the keywords. This can be done by a skillful person only to gain the needed content from some found content results and then to be combined. Non-textual is not so simple. It is hard to find although the person has used search engine.

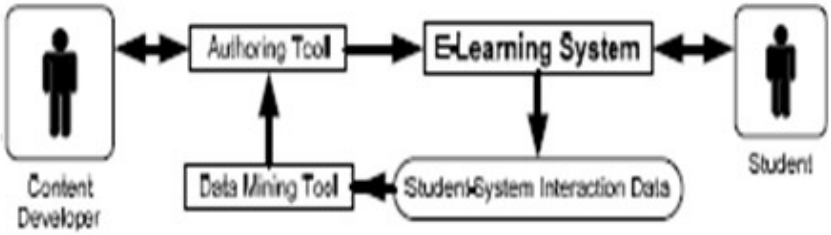
Personalization is the next step of e-Learning evolution. According to Paulo Gomes et el, learner may feel various cognitive style and create efficiency within the proper use of e-Learning system for different background and capability level. There are two personalization models: on-line personalization (picture 2), observe student

interaction through the system continuously within real time, always giving the appropriate substance content (Paulo, 2006).



Picture 2. On-line personalization model

Off-line personalization (picture 3), walked by combining provided students data that is analyzed later to gain course content change recommendation.



Picture 3. Off-line personalization model

The appearance of Web Semantic technology, Meta data may be added into e-Learning content (including pedagogy attributes) and later be organized into ontology, so it will be easier in distribution, discovery and the content use in such a better way. Through this way, it s not only human can easily find and organized needed content but also smart agent. Smart agent in the application will find and organize the content from heterogenic content source and then combine them to be customized courseware with specific criteria and other rules. This customized courseware refers to groups of content (sourced from heterogenic content) where related content and pedagogy are supported (Renaldy and Azhari, 2008)

2.e-Learning standardization

There is e-Leaning standardization that must be used as a reference of system development:

a.LTSC

It is invented by Institute of Electrical and Electronic Engineers (IEEE) that has created many standard of technology for electrical, Information Technology and Science. The aim of LSC is to form accreditation of technical standard, giving training recommendation, and a reference in learning technology.

b.IMS

IMS is an important organization in e-Learning community since consortium among academic institution, company and government to build and support open specification for learning distribution and content development and also student exchange among the different systems.

c.ADL

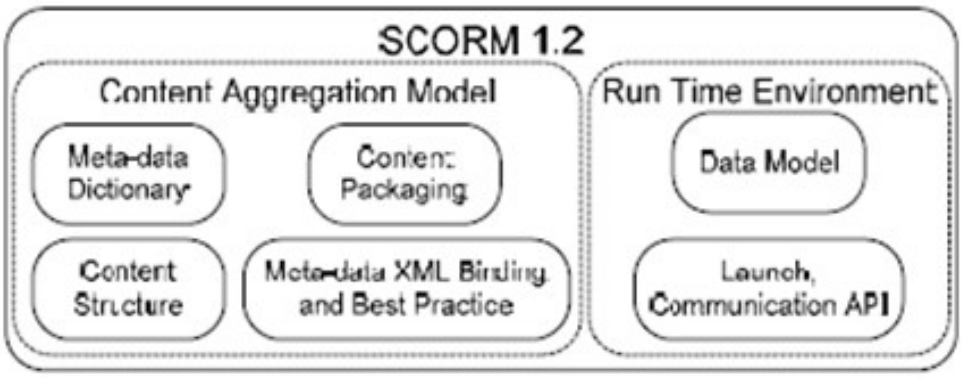
ADL create Shareable Courseware Object Reference Model (SCORM). SCORM is a standard specification for reusability and interoperability from learning content [7].

SCORM focuses on to two important aspects in interoperability from learning content:

- Defining the model aggregately to wrap learning content
- Defining API which is usable for communication between learning content and the applied system

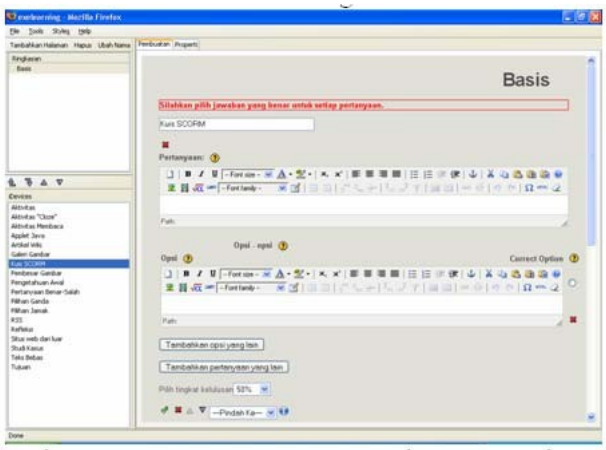
SCORM divides learning technology based on:

- Learning Management System (LMS)
- Shareable Content Object (SCOs)
-



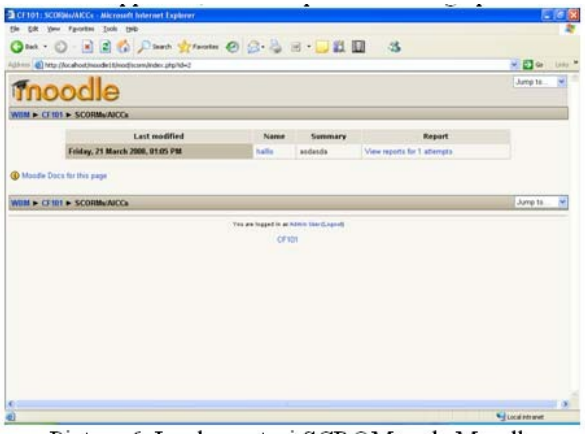
Picture 4. Component of SCROM 1.2.

There are many tools to use SCORM like eXe-Learning.



Picture 5. Penggunaan SCROM pada eXe-Learning

The use on e-Learning has been supported, for example e-Learning opensource Moodle.



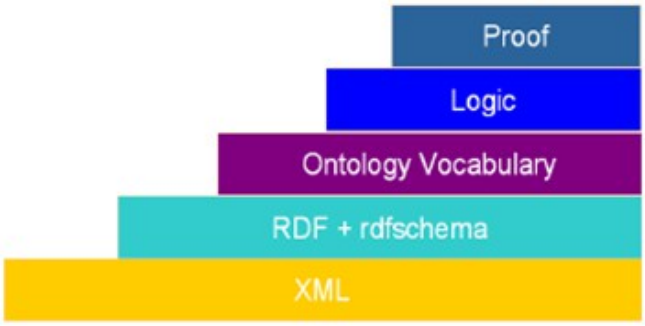
Picture 6. Implementasi SCROM pada Moodle

3. Semantic Web Technology

Semantic web is the development of the next web generation or commonly termed as the evolution of WWW (World Wide Web) issued in 2002. Semantic web is defined as groups of technology, in which it enables the computer to comprehend the meaning of information based on metadata, namely the information of the content. With the existence of metadata computer is expected to translate the input so the result will be displayed more detail and exact. W3C (World Wide Web Consortium) that define metadata format is Resource Description Format (RDF). Each unit of RDF has 3 composition namely subject, predicate and object. Subject and object are entities showed by the text. While predicate is the composition that explain subject point of view which is explained by the object. The most interesting thing from RDF is an object can be a subject which is explained later by another object. So, object or

input can be explained clearly, in detail, and appropriate with the user's will, who give the input.

In order to reach the goal, it is necessary to give meaning into each content (as attributes) which will be used by web semantic technology into several layers:



Picture 7. Layer Web Semantik

- XML Layer, represents the data
- RDF Layer, represents the meaning of data
- Ontology Layer, represents general form of rules/deals about meaning of data
- Logic Layer, applies intelligent reasoning with meaningful data.

Semantic web technology can be used to build system by collecting e-Learning content from different source to be processed, organized and shared to users or artificial agent by using ontology. There are three important technology involved in the use of semantic web namely: eXtensible Markup Language (XML), Resource Description Framework (RDF), and Ontology Web Language (OWL).

4. Ontology Web

Ontology has many definitions as explained on certain sources including what is revealed by scientist. Neches et el gives the first definition about ontology; An ontology is a definition from a basic understanding and vocabulary relation of an area as a rule from terminology combination and relation to define vocabulary.

Gruber's definition that is mostly used by people is, "Ontology is an explicit specification of conceptualism."

Barnaras, on CACTUS project, defines ontology based on its development. The definition is, "ontology gives understanding for explicit explanation of concept toward knowledge representation on a knowledge base" [5].

There is a book that defines ontology; one of them is "The Semantic Web". It defines ontology as:

1) A branch of metaphysic that focuses on nature
   and relationship among living creature

2) A theory of living creature's instinct

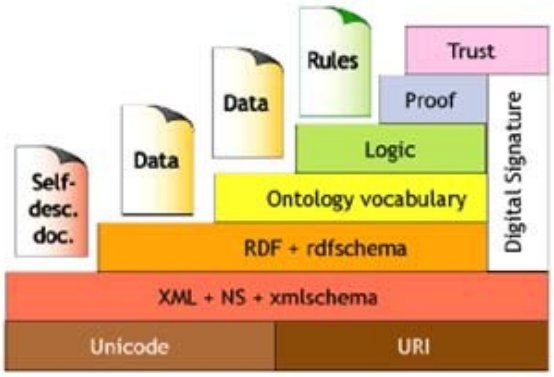
Ontology is a theory of the meaning of an object, a property of an object, and its relation which may occur on a knowledge domain. From a philosophy point of view, ontology is a study of an exist thing. Besides, ontology is a concept that systematically explains about any real/exist thing. In a field of Artificial Intelligent (AI), ontology has 2 related definitions. First, ontology is a representation of vocabulary which is specialized for domain or certain subject discussion. Second, ontology is a body of knowledge to explain a certain discussion. Generally, ontology is used on Artificial Intelligent (AI) and knowledge presentation.

All fields of knowledge may use ontology method to connect and communicate one among others about information exchange among different systems.

In order to be usable, ontology must be expressed in a real notation. An Ontology notation is a formal language of an ontology creation. Some components that become the structure are:

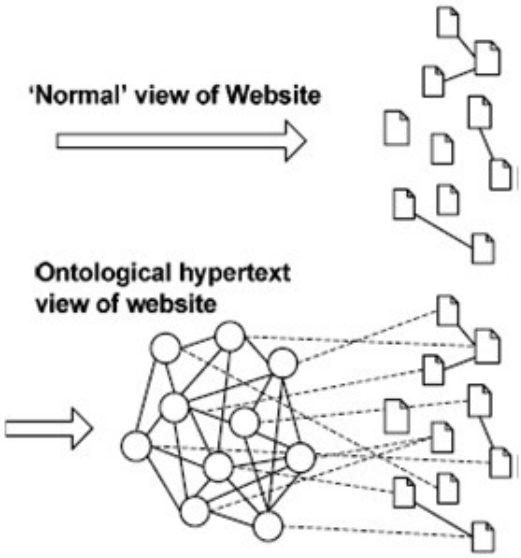
- XML provides syntax for structured documents output, but it is not forced for XML document using semantic constraints.
- XML language scheme for structure restriction of XML document.
- RDF data model for object (resources), and its relation, provides simple semantic for that data model and it may be served in XML syntax.
- RDF scheme is vocabulary to explain properties and classes from RDF source with semantics for equality hierarchy of properties and classes.
- OWL. Adds some vocabularies to explain properties and classes such as: relationships among classes (for instance, disjoint-ness), cardinality (a single one), equality, types of properties, characteristic of properties (for example, symmetry), mentioning one by one classes.

Any languages that arrange ontology, as it is explained above, have certain position in ontology structure. Each layer will have additional function and complexity from previous layer. User who has the lowest processing function may comprehend although not all ontology that is placed above[4].



Picture 8. Layer Ontology

In every layer, each part has its own function:
- XML has the function to save web page content
- RDF is the layer to represent semantics of the web page
- Ontology layer to explain vocabulary of domain
- Logic layer to take wanted data

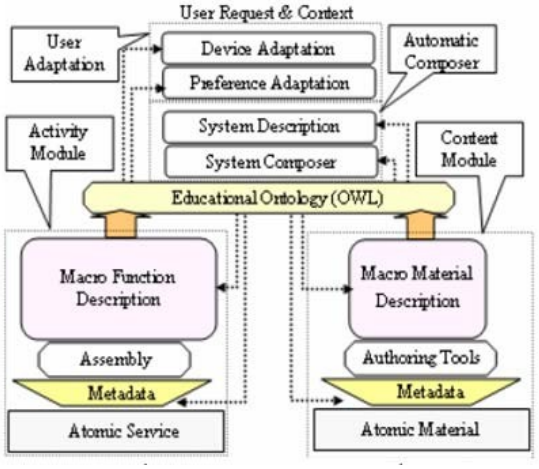


Picture 9. Organisasi website berbasis ontology

a. OntoEdu

In ontoedu, ontology is used to illustrate concept of communication and relationship of education platform. Inside Ontoedu, there are 2 kinds of ontology involved; content ontology and activity ontology.

Education ontology is the core module to rule the other component. By using ontology, ontoedu may 'learn' knowledge from education specialist and information specialist, so automatically may wrap it to be a wanted content (user content) [3].



Picture 10. Layer OntoEdu

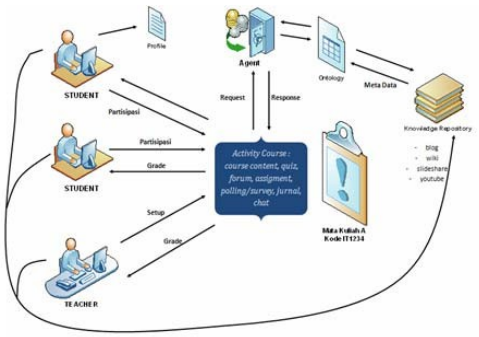
Based on ontology and semantic web technology, a planned platform education related may be created and it is flexibly named as Architecture ontoedu. There are 5 components in this ontoedu:

- user adaptation
  Receiving parameter from user that is related with adaptive transformation toward system.
- auto composition
  Being responsible to assign task as user's response
- education ontology.
  Involve ontology activity & ontology substance
- service modul
  Dynamic model used to boost learning distribution.
- content modul.
  Dynamic model used to boost learning content distribution..

5. e-Learning System Design

Smart agent development or intelligent based on production of e-Learning system personalization participates in the occurrence of e-Learning evolution itself. Agent has the capability to do the task in capacity for something or for somebody else. Therefore, by penetrating intelligent agent concept that is assigned to analyze profile, knowledge quality and learner capacity into e-Learning system, a more personal / understandable e-learning system is possible to be gained. The penetrated intelligent agent analyzes existing learning models; therefore it can be categorized as intelligent tutoring system. Intelligent tutoring system applies learning strategy pedagogically, explaining content consecutively, kinds of received feedback and how is learning substance delivered / explained.

The agent manages knowledge resources of existing web 2.0 technology on knowledge repository and its representation into the system based on ontology of the learner as well as the teacher.

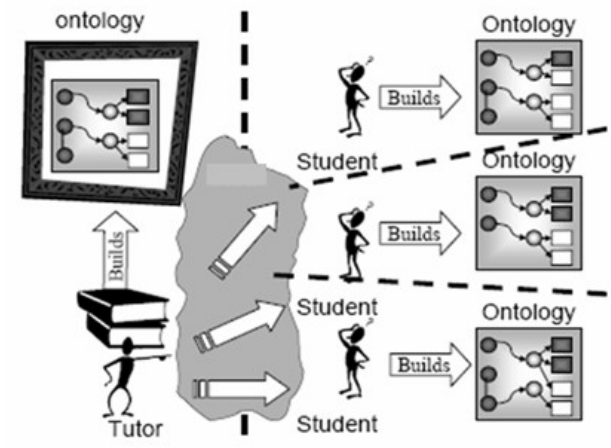


Picture 11. Personalization e-Learning Framework

The arrangement is done by creating e-Learning system that applies Asynchronous such as course content, discussion forum, mailing list, emails. Next, it is developed into Synchronous such as quiz, chatting, video-conferencing. Then, it develops ontology-based agent, which organizes tag and folksonomi in order to manage knowledge resources web2.0 technology on picture 5, like wiki, flickr, and youtube, that can be used as content course support in e-Learning system.

Picture 12. Sumber daya pengetahuan web 2.0

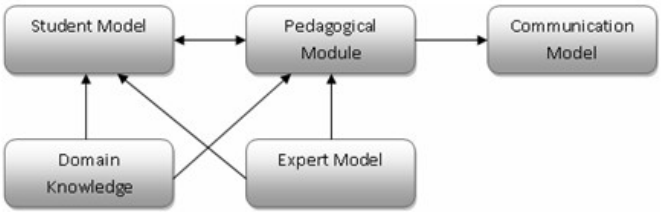
In order to support personalization towards e-Learning users, they can do 'customize interface e-Learning' including to manage knowledge resources that is collected by themselves or suggested by that system. Knowledge resources is managed by intelligent agent by applying ontology to do representation from knowledge, illustration from the mentioned knowledge formation is on picture 6.



Picture 13. Ontology hasil representasi knowledge

E-Learning system that is built applies 5 main concepts from Intelligent Learning System (picture 8), namely Student Model, Pedagogical Module, Communication Model, Domain Knowledge, Expert Model. In pedagogical module, the best achievement module is helped by agent teacher character that is capable to know the

level of learning capability and also giving motivation in the form of feedback to e-Learning user and also feedback to the teacher who is involved about course that is managed in e-Learning system.



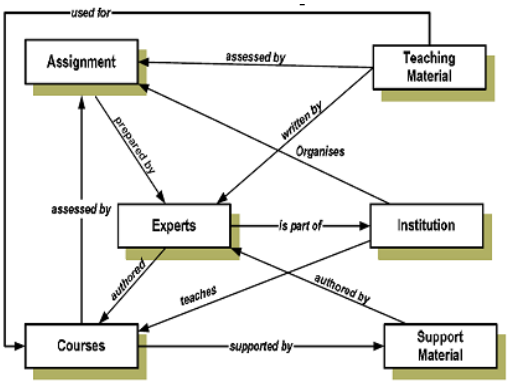
Picture 14. Main concept intelligent learning system

a. Ontology Architecture

A prototype of e-Learning is arranged as follow by using ontology on education, especially on teaching part.

In the creation of this ontology, the initial step such as searching and web browsing and then categorizing towards discovered substance and finally processed by identification and definition from main concept and metadata content [8]. The result of categorization leads to domain concept for ontology as follows:

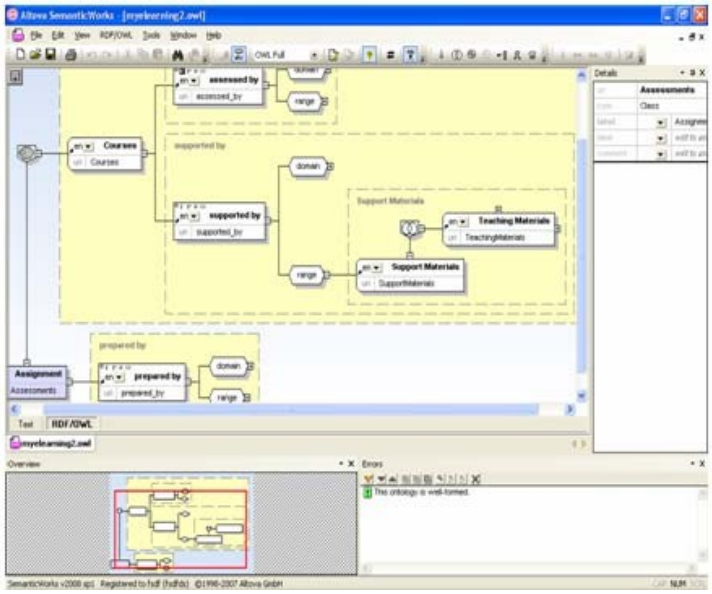
- **Courses:** identifying course with syllabuses, notes, and course works.
- **Teaching material:** such as Tutorial (article that explains tasks in detail), Lectures (lecture note/slides in various form/format), lab material, book (online book), tool (ready-to-use software), code sample, work example, and white paper.
- **Assessments:** Quizzes (brief query with brief answer), Multiple Choice Questions (MCQ) Exams tests with open question, another form of test.
- **Support Materials:** collections (all sources like homepage and portal), Background reading (basic knowledge), Forum, Resources that support learning
- **Experts:** identifying as experienced teacher community.
- **Institutions:** including organization of teacher resources, experts of the field, and university/college.

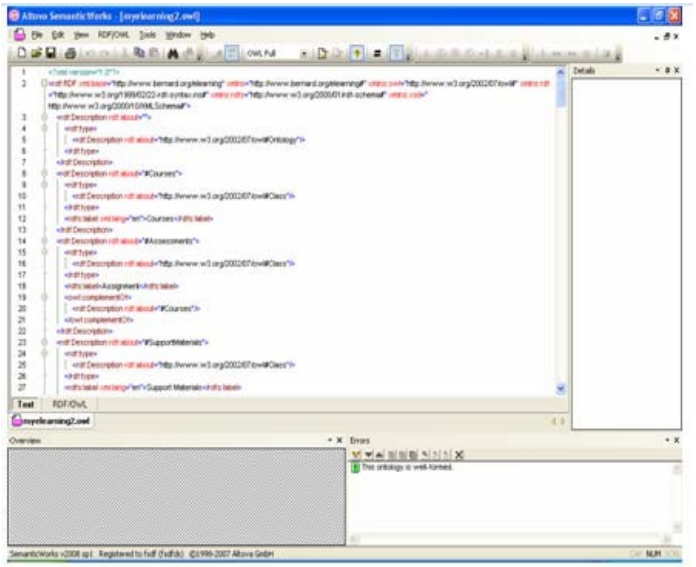


Picture 15. Skema perancangan ontology e-Learning

b. The Use of Tool Altova Semantic Work

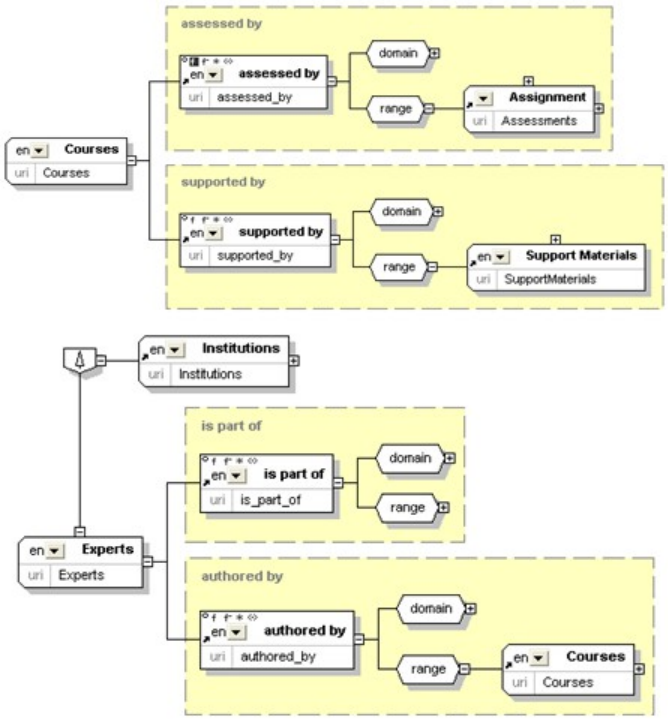
Tool altova semantic work is used to arrange ontology. By using Altova Semantic Work, ontology development is done with pictures (visual) [6]. RDF, RDFS, OWL and syntax checking are creatable and changeable. Anything related to semantics.





Picture 16. Ontology berbasis format metadata RDF.

As an example, ontology from courses and experts that is related each other can be gained as follows:



Picture 17. Diagram ontology dari Couses dan Expert

Representation form in RDF for Ontology courses is:

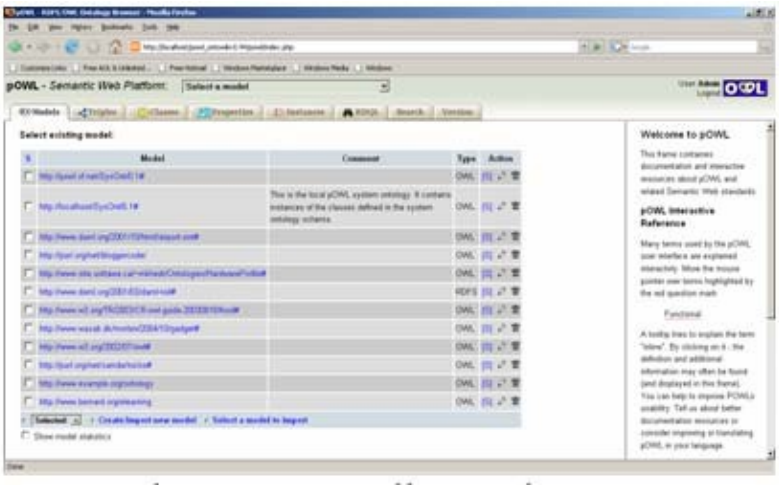
```
<rdf:Description rdf:about="#Courses">
<rdf:type>
<rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Class"/>
</rdf:type>
<rdfs:label xml:lang="en">Courses</rdfs:label>
</rdf:Description>
<rdf:Description rdf:about="#assessed_by">
<rdf:type>
<rdf:Description rdf:about="http://www.w3.org/2002/07/owl#ObjectProperty"/>
</rdf:type>
<rdfs:label xml:lang="en">assessed by</rdfs:label>
<rdf:type>
<rdf:Description rdf:about="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</rdf:type>
<rdfs:domain>
<rdf:Description rdf:about="#Courses"/>
</rdfs:domain>
<rdfs:range>
<rdf:Description rdf:about="#Assessments"/>
</rdfs:range>
</rdf:Description>
<rdf:Description rdf:about="#supported_by">
<rdf:type>
<rdf:Description rdf:about="http://www.w3.org/2002/07/owl#ObjectProperty"/>
</rdf:type>
<rdfs:label xml:lang="en">supported by</rdfs:label>
<rdfs:domain>
<rdf:Description rdf:about="#Courses"/>
</rdfs:domain>
<rdfs:range>
<rdf:Description rdf:about="#SupportMaterials"/>
</rdfs:range>
</rdf:Description>
```

Picture 18. Skema RDF ontology Couses dan Expert

It appears that domain courses have correlation as property 'assessed_by' with domain assessment and property 'support_by' with domain Support Materials.

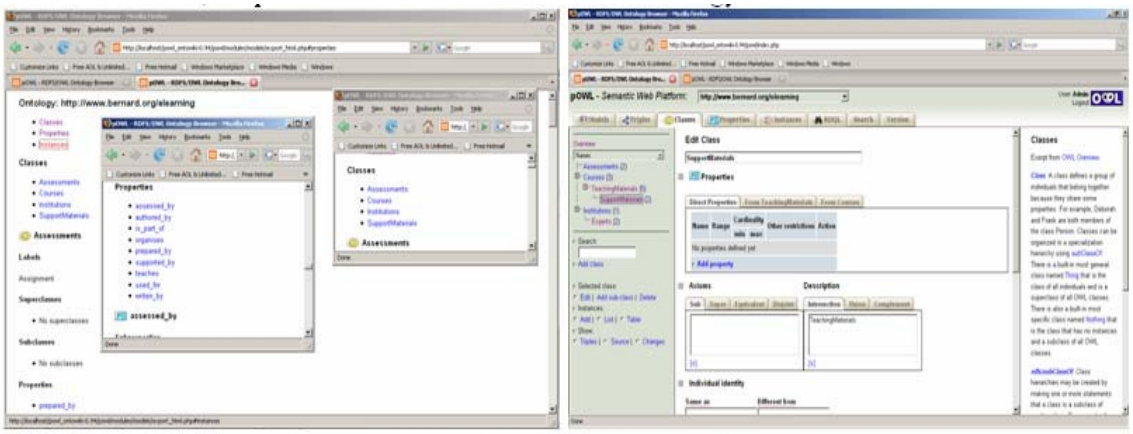
c. Ontology Testing with pOWL

The compatibility of produced ontology can be tested by using pOWL. pOWL is a web-based application that is used to collaborate semantic web creation. Owl has SQL query ability and based on API to handle RDF layer, RDFS and OWL.



Picture 19. Tampilan awal pOWL

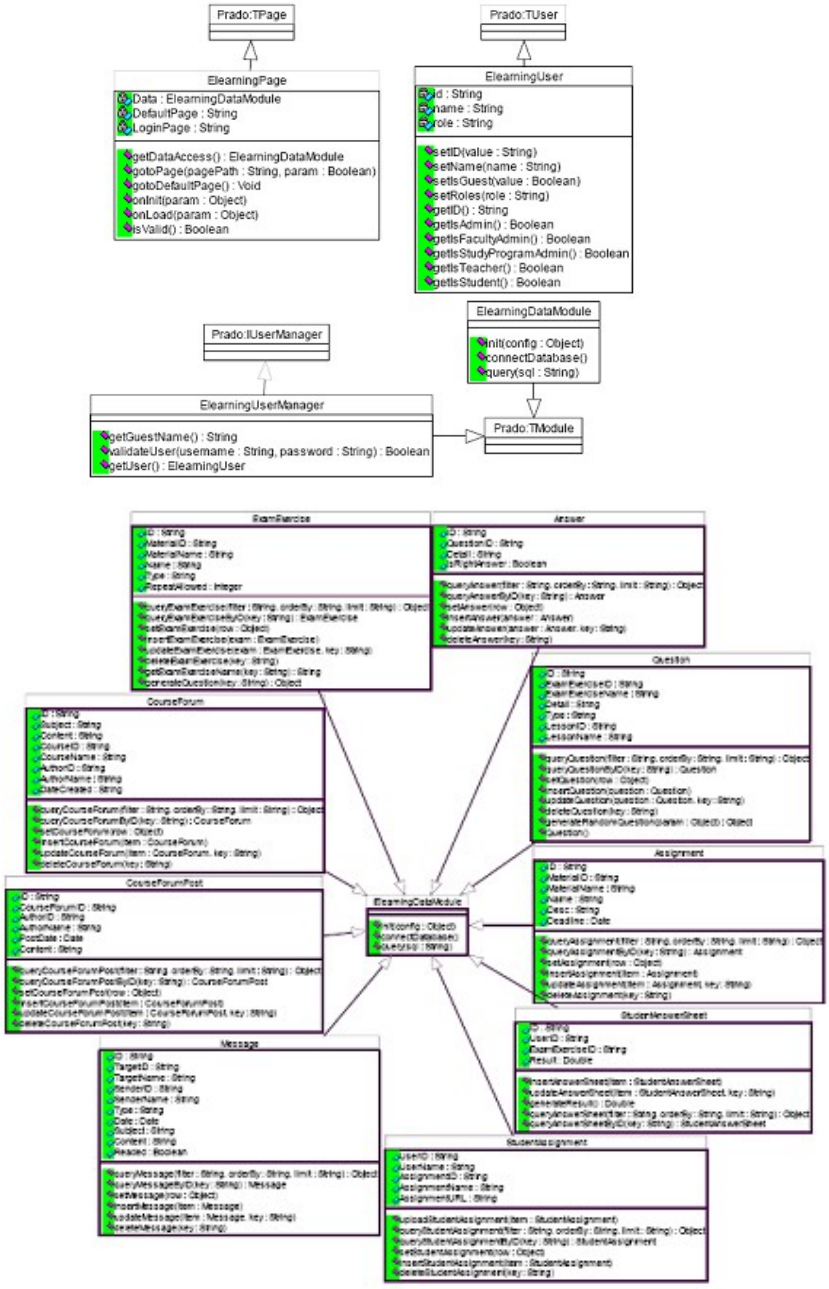
The result of Class, Properties and Instance from created Ontology can be seen as follows:



Picture 20. Tampilan Class, Properties dan Instance

6. Ontology-based e-Learning system design

The system is build based on Object Oriented programming by using LAMP technology and the use of Prado framework. Class diagram of the system are as follows:



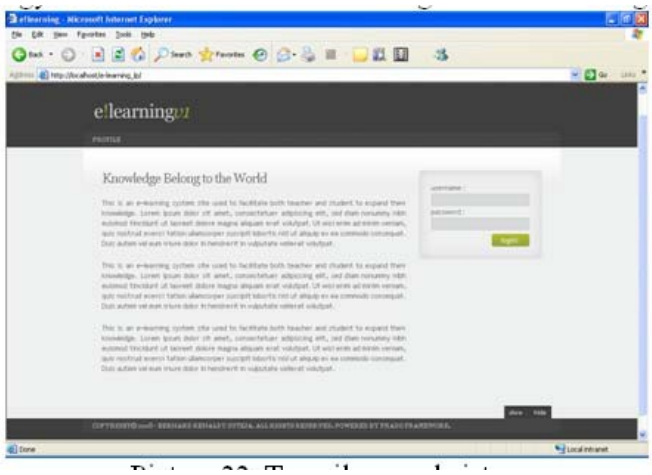
Picture 21. Class Diagram Sistem yang dibuat

Class E-Learning Page is the down line class of the class TPage. Class E-Learning Page provides methods related with page (web page), such as page change, page initialization and display or page content. The next is description of the existing method on E-LearningPage: Class TUser. Class E-LearningUser is the down line class TUser.

Class E-Learning is used to meet the need of information about user data that login. Class E-LearningDataModule is the down line class of class TModule. Class E-LearningDataModule is used to fulfill the need of connection with database.

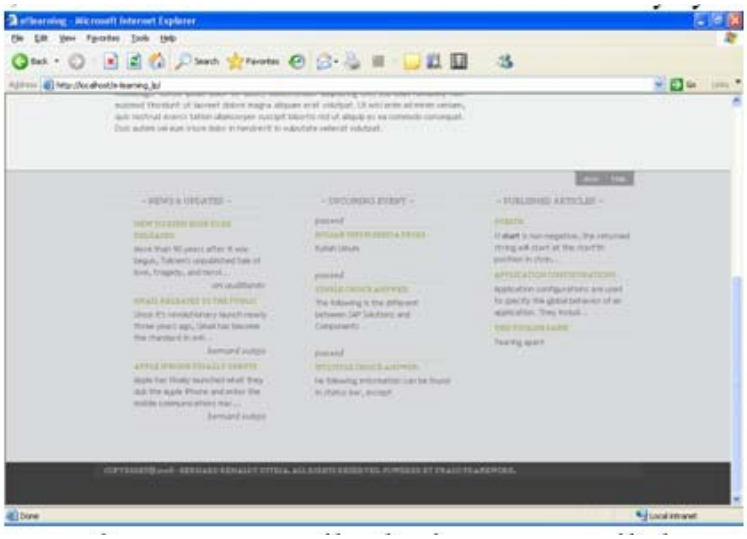
7. System Implementation

At the beginning of operation, the system will request user authentication. Each registered account will have different access right and ontology creation from formed knowledge on each learning level of the user.



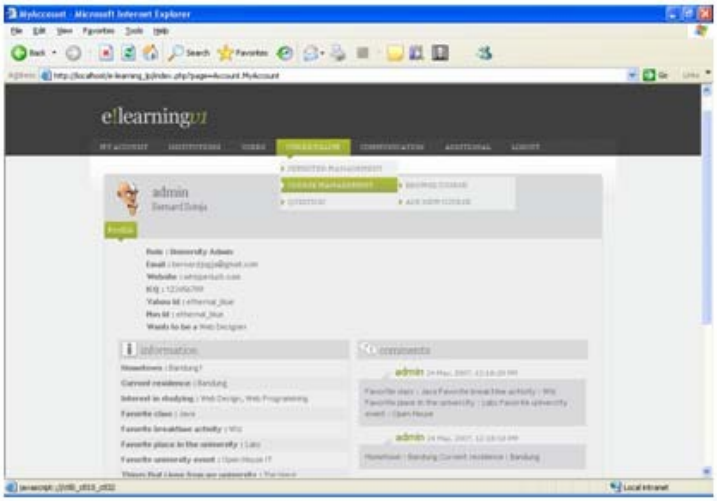
Picture 22. Tampilan awal sistem

Initially, it displays news, events, and the newest article that is administered by system administrator.



Picture 23. Tampilan berita, event, artikel

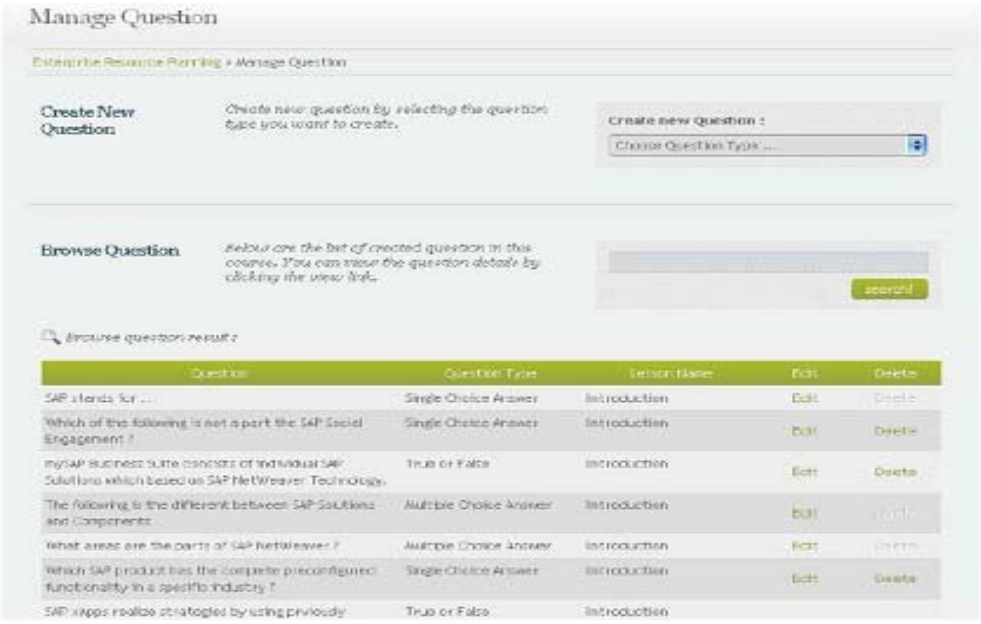
The user that login to the system will find a pull down menu that is systematically arranged on top. These menus are very dependent from access right of the user. Profile Setup will be a basic reference of agent in analyzing capability grade and system adaptation towards the user.

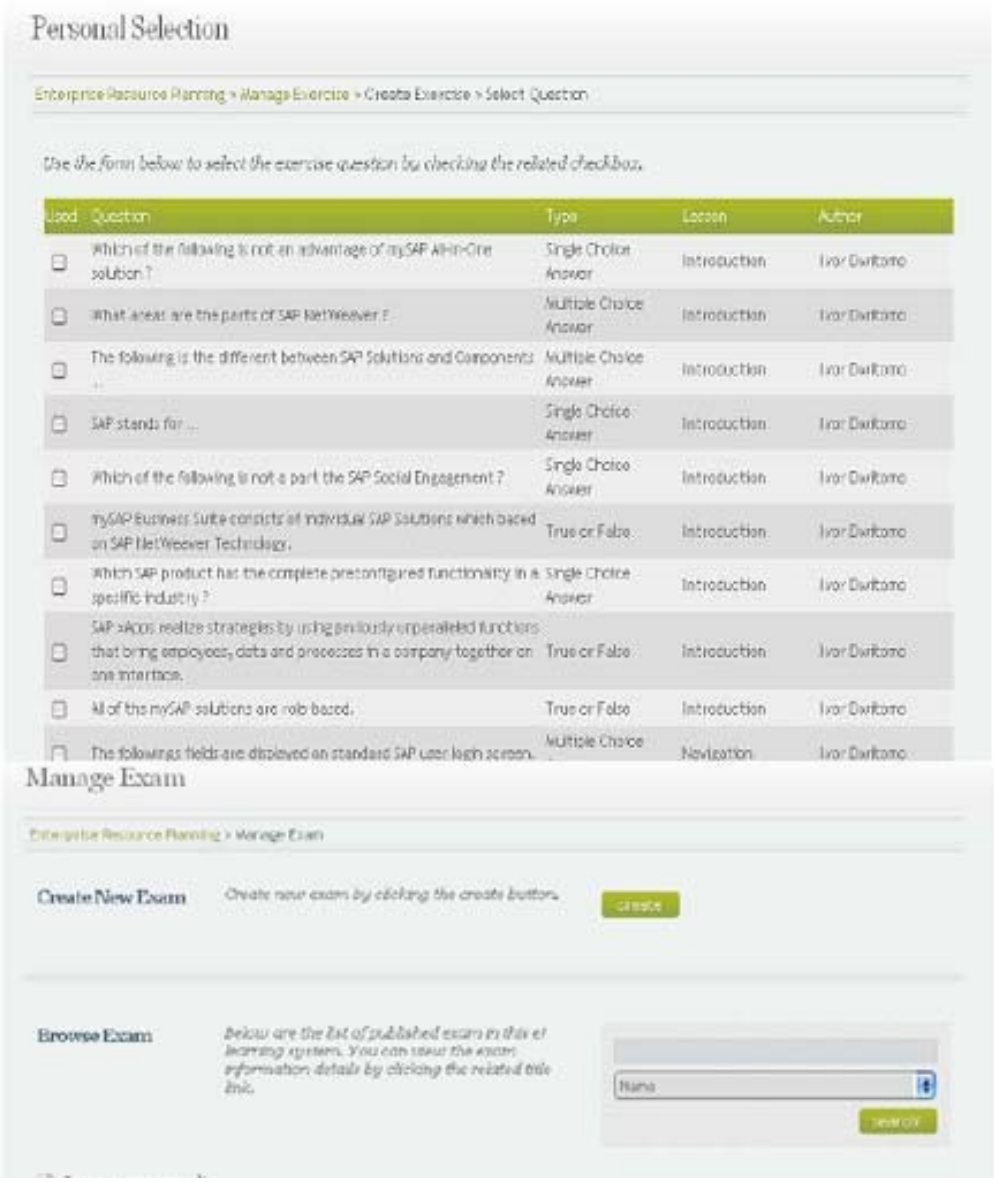


Picture 24. Tampilan Profile Pengguna

8. The management of exercises and examinations

The following part is the implementation user interface manages exercises and e-Learning application that will be developed. The present exercise is collaborated with analyses from the ontology agent towards learner capability and formed knowledge repository. So, the exercise gained by the learner will meet the grade of learner adaptation.

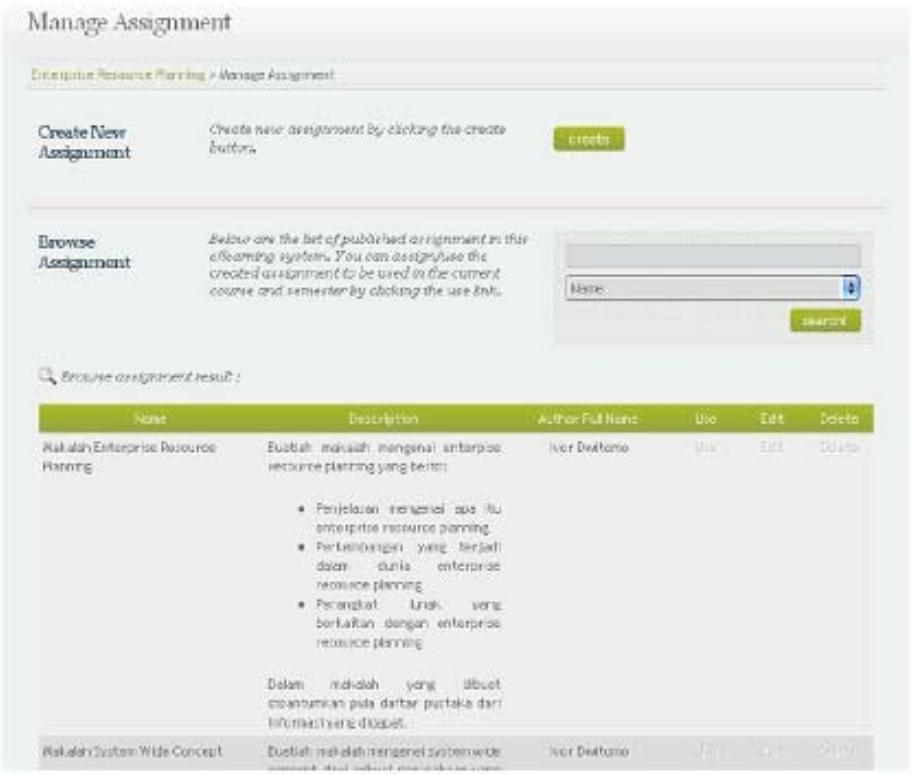




Picture 25. Tampilan Manage Soal dan Ujian

a. Manage Assignment Implementation

The following Manage Assignment Implementation is the implementation of user interface manages assignment from e-Learning application to be developed. The present assignment is collaborated with analyses from the ontology agent towards learner capability with formed knowledge repository. So, the learner may gain assignments that meet the grade of learner capability and earner adaptation. The assignment given by the agent will appear together with correlated web 2.0 knowledge resources such as wiki, flickr, and so on.



Picture 26. Tampilan Manage Tugas

CONCLUSION

Ontology that is made in this research can create well-organized e-Learning especially in the use of e-Learning content. In future, the efforts are expected to broaden or the development of ontology domains in order to create good integrity of e-Learning system itself or others.

The architecture of e-Learning prototype may use ontology on education, especially teaching and learning.

The following are conclusion of the use of ontology within e-Learning development system:

a. Increases learning quality
b. Leads the teacher and the learner to get relevant information
c. Proofs the grade of efficiency of towards retrieval of e-Learning system (the consumed time to get information)
d. Creates agent that handles repository knowledge ontology-based
e. Applies easiness to access needed information
f. Improvises and maximize teaching and/or learning of the user

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