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Indonesian Ontology Course Content using Learning Style

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***Abstract*— Fellow students have different cognitive aspects. Until now, online learning provided less take part in cognitive experience that happens to each individual student. This study, a personalized approach to online learning using an ontology. A model was developed to further students integration in the form of ontology's, allowing personalization system to guide the learning process of students. The models were developed to monitor student progress so that it can update the material and determine the matter further knowledge.**

Keywords*— Component; Ontology, Learning Style, Felder Silverman

I. INTRODUCTION

Students played a major role in the learning of traditional as well as technology in improving the learning process [15]. Each student (learner) have individual personal needs and characteristics such as different prior knowledge, cognitive abilities, learning styles, motivation, and so on. These differences affect the learning process and be a reason why some students find it easier to learn in a particular case, while others have difficulty.

Students have a different way to learn [9,10]. Students with preference (preferred) Strong for specific learning styles may have difficulties in learning if the teaching does not suit their learning styles, learning styles so that students who are not supported by the learning environment may have problems in the learning process.

Ideally, every student gets a different treatment according to the learning style of each. But certainly not easy for teachers to adjust their teaching to the needs of different students. How to teach each teacher may be suitable for the majority of students with specific learning style. but not suitable for students with other learning styles. It cannot be enforced because it is associated with the ability of each faculty itself [24].

Availability of learning content that exists today is not adaptive to ignore individual differences of students and treat all students equally regardless of their needs and personal characteristics, or so-called personalization [16]. Based learning with personalization (personalized learning) is a personal learning that adapts to any strengths, needs and interests of students [22].

In explaining the basic concepts in a domain in this case is the subject matter content as well as defining relationships in use ontology's [2]. Ontology's can be used to support a knowledge management system and opens the possibility to move from document-oriented view toward knowledge are interrelated, can be combined, and can be reused in a more flexible and dynamic. Ontology is a way of representing knowledge of the meaning of objects, properties of an object, and the object relations that may occur on the domain knowledge [5,7,25].

Course content is based on the context of the Broad Guidelines Principal Teaching (BGPT) in accordance with the curriculum used. Problems arise concerning how to provide personalized content subjects with attention to student learning styles. This study modeling the appropriate personalized learning styles of students to course content based on ontology.

II. LITERATURE REVIEW

A. Felder Silverman Learning Style Model

Personalization can also be interpreted as a negotiation between matter and information or user profile in this case is a student. Therefore, both the structure as well as information regarding the students first needed before personalization can occur [27]. Learning style is regarded as an important parameter to determine the most suitable method of learning for a learner [12]. Style of learning is an approach to learning that emphasizes the fact that individuals have the characteristics and preferences with regard to how to receive and process information in ways that are very different [1]. There are various theories that model the learning styles, one of which is the theory of Felder-Silverman learning style.

Learning style model developed by Felder and Silverman (1988) combines a four-dimensional, two-dimensional replication of the model is a Myers-Briggs and Kolb. Dimensions Perception (sensing / intuitive) analogous to Perception on the Myers-Briggs and Kolb; Dimensions Processing (active / reflective) are also found in the model Kolb. Felder-Silverman using Input dimension (visual / verbal), and Understanding (sequential / global), details the dimensions of the Felder-Silverman learning styles shown in Table 1.

TABEL 1. DIMENSIONS OF FELDER SILVERMAN

Dimensions	Learning Style	Description
Processing	Active Reflexive	How students process information
Perception	Sensitive Intuitive	Related to how students perform perceptual information
Input	Visual Verbal	Types of input information such as what is accepted students
Understanding	Sequential Global	How can students understand

Felder-Silverman learning styles model [11] divides the learning styles based on four dimensions. The learning style consists of active-reflective learning style, visual-verbal learning styles, learning styles sensing-intuitive and sequential-global learning styles.

1. Active-Reflective (Processing Dimensions)

The mental processes by which information is converted into knowledge can be grouped into two categories, namely active experimentation and reflective observation. Active experimentation is doing activities with information as to discuss, explain, or test it in various ways. Reflective observation is to examine and manipulate information introspective. Active student is someone who feels comfortable or better with the active experiment compared to reflective observation. And vice versa for students reflective [3]. Students active tend to dominate and understand information by doing an activity with him - to discuss, explain, or test it. Reflective student prefers to think of himself with a calm first. "Let's try and see what happens" are the words of a student active. "Let's think first" is the response of a reflective student. Students tend to like group work active than reflective students who prefer to work alone.

2. Sensing-Intuitive (Perception Dimensions)

Sensing and intuition to do with how a person perceives the world tendency. Sensing including observation, see or hear directly; intuition including indirect perception of the subconscious like speculation, imagination, and premonition. Everyone uses both of these, sensing and intuition, but usually a person has a tendency to one thing than others [9]. Students sensing (sensors) tend to love to learn facts, data, and experiments; Student intuitive prefers the principle and theory, and often prefers to find possibilities and relationships. Sensors like resolve the problem with the method is standard and dislike complications and surprises; intuitive like innovation and dislike repetition. Sensors will be more likely to get angry than to intuitive if they received the test material is not described explicitly in the classroom. Sensors tend impatient with details and good at remembering facts and do the job at hand; intuitive can better understand new concepts and are often more comfortable with abstractions and mathematical formulas as compared with a sensor. Sensors tend to be more practical and careful than intuitive; intuitive tend to work faster and more innovative than sensors. Sensors do not like courses that have no apparent relationship to the real world; intuitive not like the college that involves a lot of memorizing and routine calculations.

3. Visual-Verbal (Input Dimensions)

Students with good visual recall what they see - pictures, diagrams, films, demonstrations. Students verbal get more than words - both written statement or speech. Visual student may easily forget the words that others say. Students verbal get much information from the discussions and learn effective ways to explain to others. Most people at the college age and older-type visual but most college instruction is verbal - information is presented more like a lecture dominant verbal or visual representation of verbal information (words and mathematical symbols written in the books, handouts, or whiteboard).

4. Sequential-Global (Understanding Dimensions)

Most formal education using presentation materials in order progressively, chapter by chapter sequentially. When the whole matter has been discussed, students are tested mastery and then advance to the next level. Some students comfortable with this system, to learn sequentially, to master the material more or less in line with what is taught. The other, cannot learn that way. They may be out of the other for days or weeks, not even able to complete an easy matter. Until at some point they "got the message", they've got illustration. After that maybe they will be more understanding of matter and solve problems better than sequential students. They are referred to global students [9]. Students tend to get a sense of the sequential linear stages. Global Students tend to learn on large leap, receive the material at random without looking at its relationship until one day they understand. Students tend to follow the sequential stages in finding a solution. Global student can complete complex problems quickly when they've got the big picture, but they may have difficulty explaining how they did it.

Felder-Silverman learning style model is used as the basis of adaptive teaching because it is based on the following research:

1. It has been successfully implemented so that a lot of people (students) can adapt the learning material with good [4,14,17,21].
2. Has been approved by experts in their field / specialist pedagogy [8,18,29].
3. Very user-friendly and easy to interpret the results of the analysis [19].
4. The number of dimensions is controlled (controlled) and can actually be implemented [21].
5. The focus of the Engineering Student [1].

B. Ontology

Ontology is a formal explicit specification of a conceptualization [13]. Conceptualization is an abstract picture of something in the world that wants to be represented. Ontology provides a shared vocabulary that can be used to model a domain, which is the type of an object, and / or concepts that exist, and property and their relationships [3]. Ontology's are used in artificial intelligence (artificial intelligence), the semantic web, software engineering,

biomedical informatics, and on the science of informatics as a form of knowledge representation.

The basis of the design of the ontology consists of the following components:

1. Concept
   Used in a broad understanding. A concept can be something that was said, so it can also be an explanation of the duties, functions, action, strategy, and so on. Concept also known as classes, objects and categories.
2. Relation
   Represents a type of interaction between the concept of a domain. Formally can be defined as a subset of a product of n sets, R: C1 x C2 X. , , x Cn. As an example of the relation binaries includes subclass-of and connected-to.
3. Function
   Is a special relationship where the element of relationship is unique to the element to n-1. F: C1 x C2 x. , , Cn-1 ¡> Cn, for example, is Mother-of.
4. Axioms
   Used to model a sentence which always correct.
5. Instances
   Used to represent the individual elements.

III. DESIGN ONTOLOGY MODEL

Making the stages of ontology based on organizational methods of information by establishing and implementing formal ontology [20,28,6]. Here is an iterative step in the formation of ontology:

1. *Determination of the domain and scope of the ontology.*
   To determine the domain and the scope of the right approach is a question that can help:
   a. What will be handled by the domain ontology?
      Domain of study is personalized course content involves learning styles of Felder Silverman.
   b. What is the use of ontology to be formed?
      Provide knowledge of the content of learning resources appropriate to the context BGPT course learning styles of students.
   c. The type of questions that must be answered in the presence of the ontology?
      - What are the characteristics of each learning style Felder Silverman?
      - What learning resources for every subject of study?
   d. Who will use and manage ontology?
      Teachers included in the drafting team BGPT course.
2. *Considering the reuse of existing ontologies.*
   Reuse of ontology that has been made by others can be an option, especially when it is necessary to interact with other apilkasi. In this study the ontology that uses BGPT as a knowledge base content and context of learning materials appropriate learning styles of students is not yet available so that the necessary manufacture of ontology [23,24].
3. *Identification of important terms in the ontology.*
   In terms of identification is determined that the nouns will be naming the base class and the verb form the basis of naming the property.
4. *The definition of class and hierarchy*
   Hierarchy is an organization of classes and subclasses defined in this study. Defined class is a subclass of class Thing. Draft class and subclass hierarchy which is used in accordance with fig. 1.

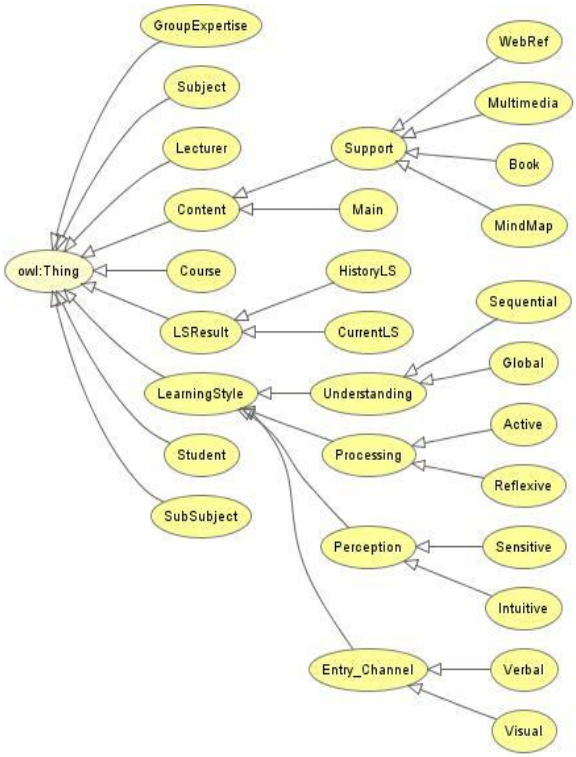


Fig. 1. The design of Hierarchy Class and Subclass

5. *Defining Property*
   The property used to describe relationships between classes. Domain student represented by student, has a value of learning styles (LSResult) and the track record of the current value of learning styles that have been obtained. A student has the organizational support content (WebRef, Book, MindMap, and Multimedia) used in the study subjects. A student also has a good learning results or Performance to learn and quiz each object used in learning. Fig. 2 is a diagram property relations class Student.

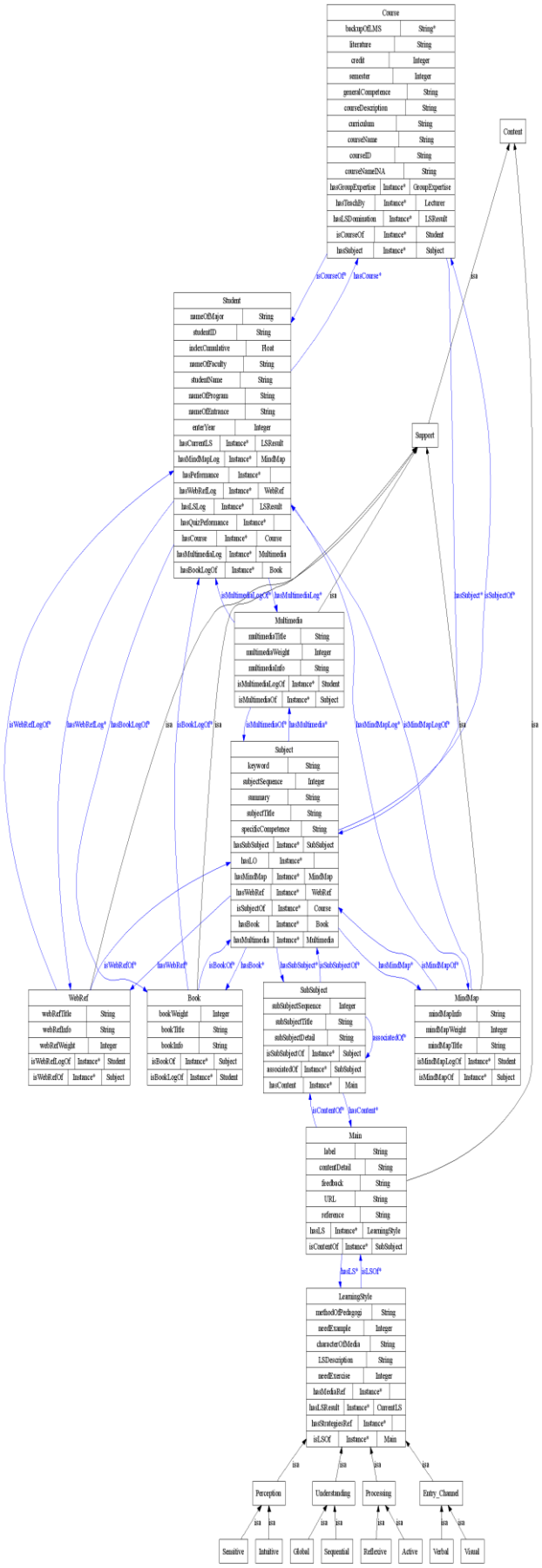


Fig. 2. Course Property Class Diagram Relationships

6. Creating Instance

Step defining an instance of the class begins by selecting a class, make individual instance of the class went on to give the value of each property that has been defined as in fig. 3.

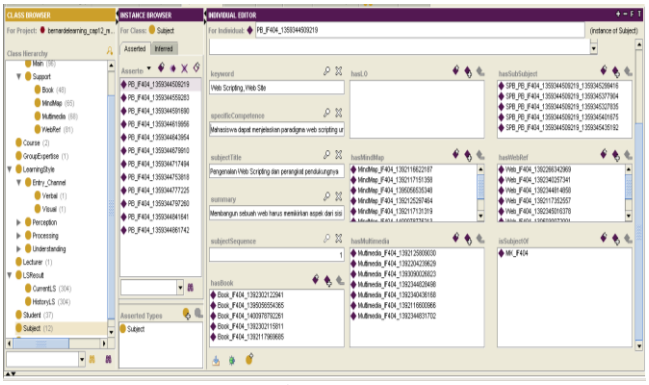
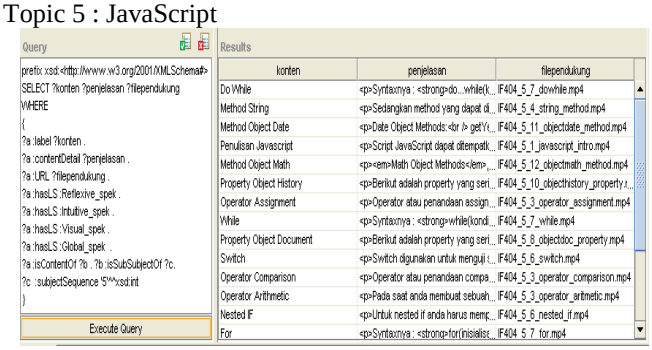


Fig. 3. Defining the Class Instance

IV. RESULTS AND TESTING

The final goal of this research is the result showed the content of the courses according to the student's learning style. The case studies used in the test was a course web programming with code IF404 in Information Engineering study program. Tests carried out using SPARQL against Reflexive learning styles, Intuitive, Visual, Global. Here are some test results to obtain content on the topics taught courses on the subject of web programming:

Topic 5 : JavaScript



Query

```
prefix xsd:<http://www.w3.org/2001/XMLSchema#>
SELECT ?konten ?penjelasan ?filependukung
WHERE
{
?a :label ?konten .
?a :contentDetail ?penjelasan .
?a :URL ?filependukung .
?a :hasLS :Reflexive_spek .
?a :hasLS :Intuitive_spek .
?a :hasLS :Visual_spek .
?a :hasLS :Global_spek .
?a :isContentOf ?b . ?b :isSubSubjectOf ?c.
?c :subjectSequence '5'^^xsd:int
}
```

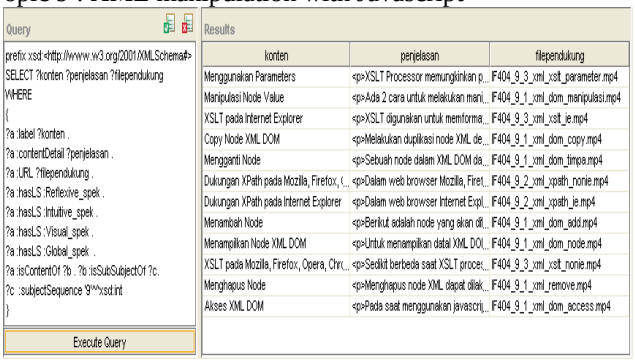
Execute Query

Results

konten	penjelasan	filependukung
Do While	<p>Syntaxnya : do...while(k...	IF404_5_7_dowhile.mp4
Method String	<p>Sedangkan method yang dapat di...	IF404_5_4_string_method.mp4
Method Object Date	<p>Date Object Methods: getYe...	IF404_5_11_objectdate_method.mp4
Penulisan Javascript	<p>Script JavaScript dapat ditempatk...	IF404_5_1_javascript_intro.mp4
Method Object Math	<p>Math Object Methods...	IF404_5_12_objectmath_method.mp4
Property Object History	<p>Berikut adalah property yang seri...	IF404_5_10_objecthistory_property....
Operator Assignment	<p>Operator atau penandaan assign...	IF404_5_3_operator_assignment.mp4
While	<p>Syntaxnya : while(kondi...	IF404_5_7_while.mp4
Property Object Document	<p>Berikut adalah property yang seri...	IF404_5_8_objectdoc_property.mp4
Switch	<p>Switch digunakan untuk menguji t...	IF404_5_6_switch.mp4
Operator Comparison	<p>Operator atau penandaan compa...	IF404_5_3_operator_comparison.mp4
Operator Arithmetic	<p>Pada saat anda membuat sebuah...	IF404_5_3_operator_aritmetic.mp4
Nested IF	<p>Untuk nested if anda harus memp...	IF404_5_6_nested_if.mp4
For	<p>Syntaxnya : for(inisialisa...	IF404_5_7_for.mp4

Fig. 4. Testing and Results for Topics Javascript

Topic 9 : XML manipulation with Javascript



Query

```
prefix xsd:<http://www.w3.org/2001/XMLSchema#>
SELECT ?konten ?penjelasan ?filependukung
WHERE
{
?a :label ?konten .
?a :contentDetail ?penjelasan .
?a :URL ?filependukung .
?a :hasLS :Reflexive_spek .
?a :hasLS :Intuitive_spek .
?a :hasLS :Visual_spek .
?a :hasLS :Global_spek .
?a :isContentOf ?b . ?b :isSubSubjectOf ?c.
?c :subjectSequence '9'^^xsd:int
}
```

Execute Query

Results

konten	penjelasan	filependukung
Menggunakan Parameters	<p>XSLT Processor memungkinkan p...	IF404_9_3_xml_xslt_parameter.mp4
Manipulasi Node Value	<p>Ada 2 cara untuk melakukan mani...	IF404_9_1_xml_dom_manipulasi.mp4
XSLT pada Internet Explorer	<p>XSLT digunakan untuk memforma...	IF404_9_3_xml_xslt_ie.mp4
Copy Node XML DOM	<p>Melakukan duplikasi node XML de...	IF404_9_1_xml_dom_copy.mp4
Mengganti Node	<p>Sebuah node dalam XML DOM da...	IF404_9_1_xml_dom_timpa.mp4
Dukungan XPath pada Mozilla, Firefox, (...	<p>Dalam web browser Mozilla, Firef...	IF404_9_2_xml_xpath_nonie.mp4
Dukungan XPath pada Internet Explorer	<p>Dalam web browser Internet Expl...	IF404_9_2_xml_xpath_ie.mp4
Menambah Node	<p>Berikut adalah node yang akan dit...	IF404_9_1_xml_dom_add.mp4
Menampilkan Node XML DOM	<p>Untuk menampilkan data1 XML DO...	IF404_9_1_xml_dom_node.mp4
XSLT pada Mozilla, Firefox, Opera, Chr...	<p>Sedikit berbeda saat XSLT proce...	IF404_9_3_xml_xslt_nonie.mp4
Menghapus Node	<p>Menghapus node XML dapat dilak...	IF404_9_1_xml_remove.mp4
Akses XML DOM	<p>Pada saat menggunakan javascri...	IF404_9_1_xml_dom_access.mp4

Fig. 5.Topics Testing and Results for XML manipulation with Javascript

V. CONCLUSIONS

Personalized ontology model for content-based subjects Silverman learning style Felder case study web programming courses in Information Engineering study program has successfully created and tested. Ontologies are implemented to organize content according BGPT knowledge and learning styles of students.

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