Web e-Learning Component Analysis: A Metamodel

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Abstract

Research focus on learning technologies currently classified into three main themes included pedagogical aspect, underpinning technology, and organizational issues. In particular, there is an expand research on how to explore learning technologies in order to support the communication and collaboration by increasing focus on relevant pedagogical and organizational issues. Concerns that appear in every research focus can be related to determine the specific component of web e-learning. Analysis of specific component then required to describe all aspects that support the web e-learning implementation. Final result from this analysis is initialization of web e-learning component in logical and technical along with it relations by proposed a web e-learning component metamodel.

Keywords: Web e-Learning, Component, Metamodel, Learning Media

1. Introduction

Number of identified concern in the realm of web e-learning research can be a challenge, especially in terms of concept understanding. There are three main focuses included pedagogical, technology and organizational within the framework of e-learning research [1]. From all kind of e-learning, we prefer web e-learning as focus of understanding because it positioned as the most widely used in academic institution [2, 3].

Pedagogical aspect can affect the using of web e- learning in several research area [1]. In order to implement web e-learning, effective pedagogy should be combined with the technologies that are reliable and easy to use [4]. Beside pedagogical aspect that

describe learning goal through web media, organizational issue become another concern in optimizing web e-learning [5]. Stakeholder involvement in web e-learning system includes motivation, attention, and responsi-bilities must be analyzed specifically in order to meet the user needs from web e-learning development [5]. Educational technology support collaborative aspects on web e-learning optimally by sharing knowledge and support user activities through the provision of facilities such as review activities, online courses, assignment, online quiz, online forums, discussions and another collaborative activities among users [6, 7, 8].

Learning technologies should be support the communication and collaboration by increasing focus on relevant pedagogical and organizational issues [9, 10]. To support the development and optimize the use of web e-learning, analysis of related compo-nent is required to describe all supporting aspect and it relations. Representation of all components as an object is forming in a metamodel that support the object class formation. This research is dedicated to give an insight in capturing web e-learning environment from identified concerns entirely.

2. Methods

2.1 Related Work

The identified component of web e-learning is related with research focus of learning technologies that classified into pedagogical, technology and organizational based on e-learning research framework [1]. Pedagogical aspect [4, 11, 12] consist of several concerns including interaction to learning integration [12], communication to deliver information [13], content development in learning process [14], and assessment to evaluate [7].

Research that identify learning technologies consist of e-learning standard system [13], architecture of e-learning concern in teaching and training activity [15] and basic technologies in LMS ([16, 17, 18, 19]). Research of organizational issues [5] then covered the understanding from motivation and attention to know the responsibilities and roles each stakeholder in e-learning system.

All researches describe concern in web e-learning area separately, so that our research try to relate the basic concepts of web e-learning through component initialization and describe learning environment comprehensively.

## 2.2 Concern Identification From Literature Studies

Research confine the component in several categories based on concern identification from literature studies such in **Table 1**.

Table 1. *Web e-learning concern identification from literature studies.*

| Research Focus	Concern		Early Component Identification	Reference
Pedagogical Aspect (P)	Behaviourism		Assessment	[7]
	Cognitivism		Content Development	[13]
	Constructive		Communication	[12]
			Interaction	[11]
Underpining Technology (T)	System Standard		Learning Management System (LMS)	[12] [4]
	System Architecture		Global Architecture from Teaching and Training System	[14]
	Technology & Tools	Data Management	Learner Data (assessment data and external factor)	[14]
			Interaction Data	
			Content Material Data	
		Learning Visualiza-tion	Interface	[17]
			Navigation	[8]
			Personalization	[21]
			Content Type	[13]
		Technical Aspect	Platforms	[2]
			Tools or Features	[20]
Organizational Issue (O)	Stakeholder		Stakeholder in academic range	[5]

Learning technologies becoming core of effective web e-learning implementation that support the pedagogical and organizational issues. The right choice of learning technologies, especially in LMS-based can suggest the right tools based on system

requirements. Flow on **Figure 1** fill the component aspects through concept understanding, especially in terms of logical and technical.
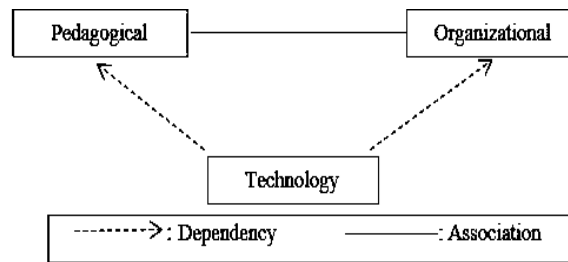
Figure 1. *Flow of web e-learning aspect compliance.*

Web e-learning research focus then classify web e-learning early components logically to describe the aspect of learning support including pedagogical and organization,while technical side detail the supporting technology, tools and resources from web e-learning application. The early component classification can be seen on **Figure 2.**
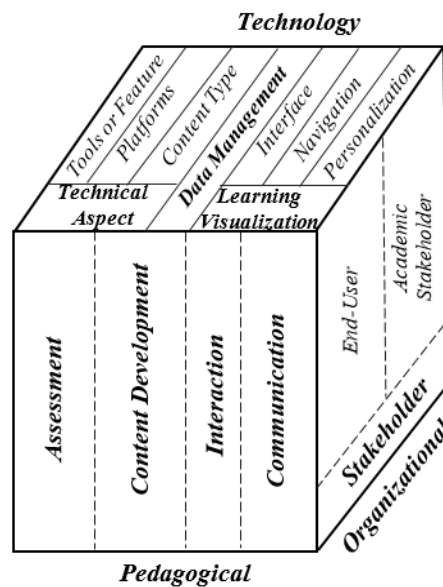
Figure 2. *Web e-learning components classification model.*

3. Result and Discussion

3.1 Web e-Learning Component Initialization

Component relation in LMS-based structure represent pedagogical aspect, supporting technology and user element through metamodel of web e-learning components consisting of:

1. Web e-Learning Logical Component

Logical components are identified from pedagogical aspect and stakeholder that compliance web e-learning system. Some of logically related components that is:

a. Interaction

Internal interaction involves end users by providing learning visualization (interface, navigation, personalization) and learning content.

Academic stakeholders interact to system externally through regulatory support and provide web-based learning environment.

b. Communication

Communication gives feedback on learning and discussion to learner and instructor through communication media.

c. Content Development

Learning content and data are managed in a database by instructor or administrator.

d. Assessment

Prepare tools to assist the assessment process and monitor learning for end user (learner, instructor).
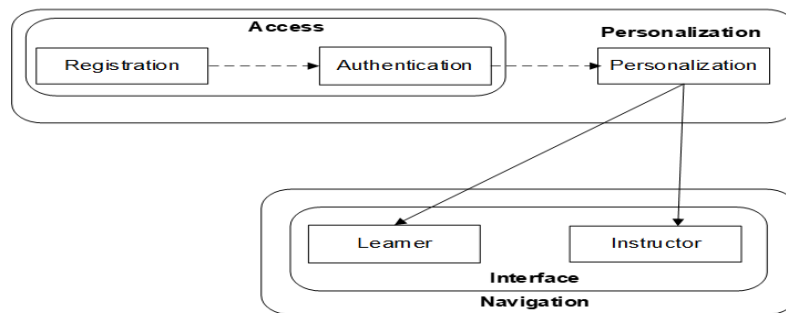
2. Web e-Learning Technical Component

Technological aspect particularly has a role as the core of web e-learning through component provision that compliance logic requirement. Identified technical components involved:

a. Data Management

Query can be used to sort information based on preference and keyword. Resources management in course database help to maintain learning data such as learner data (assessment data and other external factors), interaction data and material content data.

b. Learning Visualization

An ideal web e-learning must prepare the system access procedure based on user classification. Access specifically have a stage to verify user in web e-learning system. After successfully verified the access, connection between navigation and interface in personalization are identified such in **Figure 3**.

Figure 3. Relation of learning visualization components

c. Technical Support

Technical aspect identification is done by detailing the supporting technology that being used to develop system environment including description of content type, platforms and tools or features that are provided to support web-based learning.

3. Analysis of Logical and Technical Component Relevance

Identification carried out on components and LMS standard classification to prove the concerns relevance. Component that identified is used to compliance LMS structure in logical and technical through interaction system.

3.2 Web e-Learning Component Metamodel

Web e-learning component identification in logical and technical interrelat the specified component from separated concerns and applicable to describe web e-learning require-ment. Every identified components can be mapped as entities through metamodel to support object class formation. Trivially, component entities in particular and its relation are explained in web e-learning component metamodel. Component relation of web e-learning then firstly explained in **Table 2.**

Table 2. *Web e-learning component relevance.*

Component Relevance		Description
Logic a.Pedagogical (P) b.Organizational (O)	1.	Interaction (P) internally involve end users (O).
	2.	Interaction (P) externally involve academic stakeholders to supports the web-based learning system environment (O).
	3.	Communications (P) in learning process involve learner and instructor (O).
	4.	Data management and learning content (P) is managed by administrator and instructor (O).
	5.	Assessment and monitor of learning (P) is done from instructor to learner (O).
Technical (T)	1.	Provision of technical aspects include: a. Determining the content type b. Platforms (Internet Services) c. Tools or Features Technical aspects must support pedagogical and organizational involvement to prepare web-based learning environment.
Logical & Technical	1.	Technological support is needed in data management (learner data, interaction data, course material data) and data base management (T) →Content development (P) is provided by administrator and instructor (O).
	2.	Visualization is supported through the provision of learning interface, navigation, personalization (T)→ Interaction, Communi-cation, Assessment (P) of end user (O).

Metamodel of web e-learning component is depicted later in **Figure 4** to show that all phases in component analysis from concern identification until components initialization are success to elaborate specific components and it relation in web e-learning system especially in LMS environment.
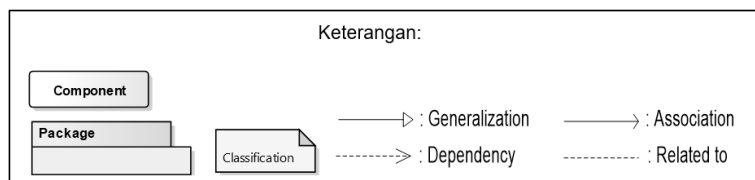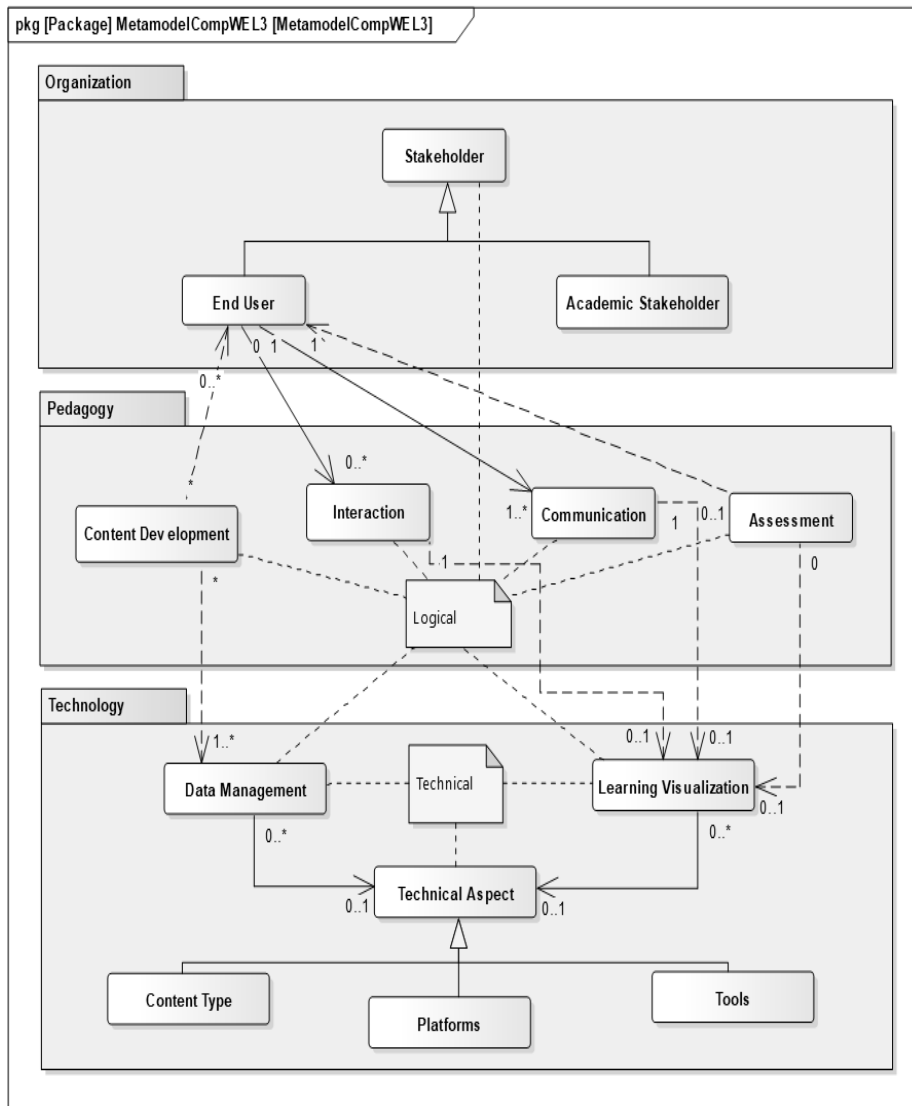
Figure 4. *Web e-learning component metamodel.*

4. Conclusion

Basic concepts of web e-learning from separated concerns are success to be examined through three main themes include pedagogical aspect, underpining technology and organizational issues. Research show that all identified concerns and aspect from web e-learning area can be used to initialize component specifically in LMS-based environment. Component of web e-learning then classified in logical (pedagogical, organizational) and technical to analyse the relevance between component in web e-learning environment. Final result from this research is metamodel of web e-learning component that represent all identified components as an entities to support the object class formation. Future research that following analysis of web e-learning component is capturing the requirement that logically supported by specific component in web e-learning system.

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