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Content Modeling Based on Social Network Community Activity

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Abstract—The advancement of knowledge society has enabled the social network community (SNC) to be perceived as another space for learning where individuals produce, share, and apply content in self-directed ways. The content generated within social networks provides information of value for the participants in real time. Thus, this study proposes the social network community activity-based content model (SoACo Model), which takes SNC-based activities and embodies them within learning objects. The SoACo Model consists of content objects, aggregation levels, and information models. Content objects are composed of relationship-building elements, including real-time, changeable activities such as making friends, and participation-activity elements such as "Liking" specific content. Aggregation levels apply one of three granularity levels considering the reusability of elements: activity assets, real-time, changeable learning objects, and content. The SoACo Model is meaningful because it transforms SNC-based activities into learning objects for learning and teaching activities and applies to learning management systems since they organize activities -- such as tweets from Twitter -- depending on the teacher's intention.

Keywords—Social network community activities, content model, learning objects, content granularity, content aggregation level

1. INTRODUCTION

The so-called "learning society" characterizes the 21st century [1]. Learning is fundamentally accomplished through the process of acquiring, sharing, and creating knowledge through social activities. With the advancement of the knowledge society, people now engage in such activities in online networks [2], which are characterized by changing participants, space, and content. Above all, the social network community (SNC), as another space for participation, underpins such changes. In general, SNC supports activities such as building relationships, producing and sharing content with others, and searching and sharing others' content based on personal profiles. Participants engage in these activities to form social relationships and learn how to manage and develop such relationships [3,4].

The content generated in such manner is short, unofficial, and often represented via external links. Moreover, the content serves as a source that provides information of value to users [5,6]. From the perspective of social constructivism, such SNC activities are part of knowledge-

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sharing activities through self-directed knowledge construction [7,8].

In this context, this study proposes the social network community activity-based content model (SoACo Model), which extends perspectives on educational resources to SNC activities and transforms such activities into learning objects (LOs) applicable to education support systems.

This study consists of four sections. After the introduction, Section 2 deals with the theoretical rationale behind the content model and the established theories related to content modeling. Section 3 details the SoACo Model representing the content of SNC activities. Section 4 presents the conclusion of this study and suggests future directions.

2. RELATED WORK

2.1 Theoretical background for content modeling

Learning objects represent content-related concepts and teaching-learning methods so that a range of content can be used for purposes of teaching and learning. These learning objects are based on the content model in line with content granularity. The background theories underlying the content model include information mapping, structured writing, and component display theories.

Horn developed information mapping as a methodology for businesses to solve communication difficulties via documents [9-11]. For the purpose of document-based communication, information mapping represents documents -- or writings -- using hierarchically structured information blocks and information maps. An information block represents a single theme and a single purpose, and it is constructed via the loose aggregation of modules of multiple information types and information block types. These information blocks are labeled for differentiation. Information maps deliver more extensive meanings. Based on six types of maps (conceptual, procedural, process, classification, structural, decision), multiple information blocks are aggregated. The aggregation of information maps constructs units or courses, assuming the most extensive meanings. The information mapping procedure consists of identifying, categorizing, interrelating, and presenting phases.

Information Mapping was not widely used due to its patent protection; Horn replaced it with structured writing, which was targeted at writing sentences, defining one paragraph as an information block. Moreover, structured writing defines a single theme for a single, clear purpose as an information chunk [12,13]. In structured writing, all writings are defined, and their content is classified based on seven types of information (concept, fact, classification, structure, principle, procedure, and process).

Finally, David Merrill proposed the component display theory, which consists of a two-dimensional system for categorizing the goals of learning and a two-phase presentation form targeted at learning. The system for categorizing the goals of learning is composed of content and performance levels, whereas the presentation form is constructed to indicate the goals of learning for certain classes [12-14]. The system for categorizing the goals of learning is a two-dimensional matrix consisting of content and performance. Content includes four types: fact, concept, procedure, and principle. Performance has three levels: find, use, and remember. The presentation form consists of primary presentation types and secondary presentation types. The primary presentation types consist of four elements: 1) rules for describing generalizations; 2)

examples for describing instances; 3) recall for restructuring generalizations, and; 4) practice for restructuring instances. Secondary presentation types include five elements: prerequisites, goals, references, mnemonics, and feedback.

Based on the designing principles for these theories, content is structured, aggregated, and represented for the purpose of learning.

2.2 Established content models

Content models were introduced to visualize abstract definitions and concepts of learning objects. Based on content models, elementary units of educational resources have been defined; their organic aggregation has led to the development of teaching-learning content, which provides effective production and efficient reuse and/or repurposing of resources. Content models suggested to date include CISCO RIO/RLO, IEEE LOM, and ADL SCORM [12,13,15] [16-18].

In particular, SCORM was suggested by the US Advanced Distributed Learning (ADL) Initiative based on IEEE LOM and IMS Content Packaging Information Model from IMS Global Learning Consortium, Inc., and has been used most widely in the industry. The SCORM model defines a framework for object-based learning content and involves three aggregation levels [12,13,15,16,19]. Specifically, “Assets” are the fundamental form of digitized individual media, constituting the elementary unit of resources. Assets are combined to serve as components, which in turn form other assets. Shareable content objects (SCO) run on its own, possibly involving other elements. Content is the highest granularity level, encompassing assets, SCO, and activities.

In addition, a range of other content models exist: the netg model, the learnativity content model, the dynamic learning content management system component model, the didactical model, the semantic learning model, the abstract learning object content model, the object-oriented generic learning object model, and the learning context model [12,13,15,16,20,21].

These content models are based on the information mapping, structured writing, and component display theories. Content models basically turn resources into learning objects and present diverse levels of granularity, considering the fact that the extent to which content is reused depends on the level of its granularity. Nonetheless, excessive granularity could impair contextual meanings that the content intends to convey.

Recently, some studies on content models have attempted contextual approaches as in the learning object context model in line with the prevalence of web 2.0. Nonetheless, very few studies have delved into the representation of novel types of resources such as social activities and social resources.

3. SoACo Modeling

The content of SNC activities is part of a logical type that continues to change in real time and needs be recognized as learning objects based on content models so as to be applicable to the established education support system. To accomplish this, we suggest what we call the social network community activity-based content model, wherein the real-time, changeable content of social activities is represented in a content model so as to be applicable to the teaching-learning activities intended by instructors. The following sub-sections will explain the principle for the modeling, decide on target domains, and elicit specific elements:

3.1 Principle for modeling

Modeling represents complex things from the real world of related domains with abstract notions [22]. Content modeling refers to the process of substantiating concepts associated with the content. The elements of the principle underlying teaching-learning content modeling include the following [23-25]:

- Modeling should be based on established content models.
- The content representation model should be based on visual representation.
- The content representation model should be able to separate certain objects from the base system and maintain their relationship with the system.
- The content representation model should be able to separate the elementary units of modeling.
- For service purposes, content should be encoded in compliance with certain forms to the extent that education support systems (e.g., LMS/LCMS/LRMS/LORs) can create, save, share, and apply the results of the modeling.

3.2 Domain for content modeling

This study focuses on SNC as the domain for the content model and, from it, derives the elements for the model. SNC is a service space where individuals share activities based on social resources or digital resources. Table 1 outlines the activities for creating and sharing resources on Facebook and Twitter as the two dominant SNCs [26-29].

Table 1. Typical activities for creating and sharing social resources

Facebook			Twitter		
Category	**Activity Level1**	**Activity Level2**	**Category**	**Activity Level1**	**Activity Level2**
Wall	Post	Like Comment	Tweet	Tweet (feed)	Reply Retweet
	Like Comment			Reply Favorite	
	Add Friend			Retweet	
People	Wall	Post Like Comment	People	Following	Reply Favorite Retweet
	Add Friend			Follower	Reply Favorite Retweet
Page	Post	Share			
	Like Comment				
Group	Post				
	Like Comment				

An SNC activity largely serves to build interpersonal relationships and share social resources on themes of interest. Relationship-building elements include making and adding friends, whereas a participation activity includes writing (Post, Reply), liking (Like, Favorite), commenting (Comment), and sharing (Share, Retweet).

The model constructed in this study uses the content created via the abovementioned activities and their elements and reuses the content for teaching and learning, differing greatly from the purposes originally intended for such content.

3.3 Content modeling

Content modeling defines and represents the relevant content elements to provide learning experiences [19]. The SoACo Model involves defining the SNC activity as learning objects and representing content objects, content granularity levels, content aggregation levels, and content packaging.

3.3.1 Learning Objects

The SoACo Model represents the real-time interactive features of an SNC activity. The elements for modeling the content are constructed by adding the real-time activity to teaching-learning and information granularity elements. These elements sort out the difficulties of the established content-modeling elements in representing the increasingly novel content of SNC activities, i.e., teaching-learning (pedagogy) and information granularity elements. Regarding the definition of LO for the content model, following Willey's "Just the Right" concept, learning objects are digital assets; they have granularity, and they become applicable to teaching and learning by repurposing the content generated by means of several activities [30]. For example, although the content of activities on Twitter was not originally intended for education, it can be constructed into learning objects and reused for different purposes.

To represent learning objects specifically, elements supporting teaching and learning need to be considered. Here, resource, technology, and teaching-learning theory based on SNC activities are considered. First, the resource element largely consists of SNC activity and fixed resources. An SNC activity consists of relationship-building elements (including making friends) and participation activity (such as writing, liking, and sharing). Fixed resources are composed of static digital resources and social media resources. Next, the technology element consists of network connection elements based on digital resources for real-time activities and independent elements for activities regardless of time. Finally, teaching-learning theory is composed of social constructivism elements that generate and share content as well as restructure knowledge via SNC activities (e.g., feeds, debates) [31].

3.3.2 Content granularity levels and aggregation levels

The content model based on SNC activities has aggregation levels as in Figure 1, where asset, learning object, and content form the basis of a three-level granularity.

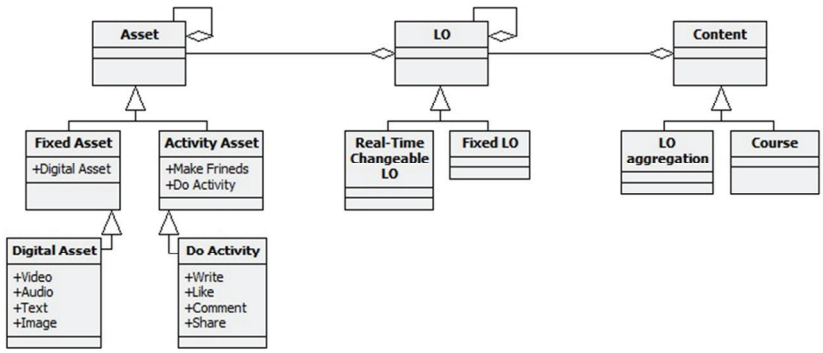


Fig. 1. Aggregation levels in the content model

First, an asset is the elementary unit that constructs the content, which is subdivided into fixed asset and activity asset. The term “fixed asset” refers to established resources of text, image, audio, and video represented in electronic media, whereas the term “activity asset” pertains to the SNC activity consisting of making friends and other forms of participation. Next, learning objects support learning activities with a view to learning, consisting of fixed LO and real-time, changeable LO. Fixed learning objects are conventional learning objects. Real-time, changeable learning objects include activity assets (SNC-based friend making and participation). Finally, content is a collection of assets and learning objects to support teaching-learning activities.

Asset, LO, and content are individual entities that assume independent meanings and deliver more extensive meanings via aggregation with one another. In other words, an asset is an element for constructing an LO, which is an element in content. Both asset and LOs are also elements for content. These relationships are briefly expressed as follows:

- Content = {Real-Time, Changeable LO, Fixed LO, Activity Asset, Fixed Asset}
- Learning Object = {Activity Asset, Fixed Asset}
- Asset = {Make Friends, Post, Like, Comment, Share, Video, Audio, Text, Image}

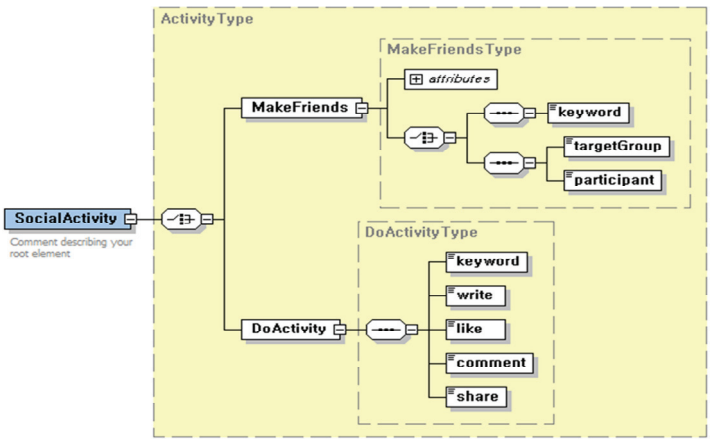
3.3.3 SNC activity elements for the content model

The SoACo Model’s activity assets and real-time, changeable learning objects consist of SNC activity elements, which are essential to the content model and should be represented with applicable information models. The information model concerning SNC activities is defined as a group of elements under <SocialActivity>, which refers to social activities as part of the container element. Specifically, the model consists of the social activity element <SocialActivity>, the relationship building element <MakeFriends>, and the participation element <DoActivity>. Each of these elements consists of a Structure and a Social Activity Type as well as Elements.

- Social activity element: <SocialActivity>

<SocialActivity> specifies information on relationship building for social activities and participation activities. Table 2 outlines the structure and information model for the <Social Activity> element.

Table 2. Social Activity element and its information model

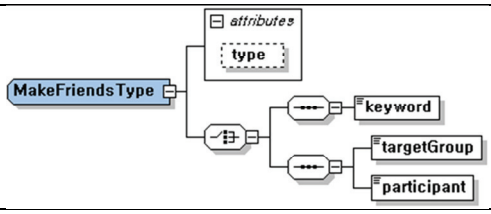
Structure	

Social activity type	<SocialActivity> is the parent element. - The parent element has no values associated with itself. - The parent element serves as container for other elements and attributes.
Elements	<SocialActivity> - It is an element defining social-activity elements. <MakeFriends> <DoActivity>

• Relationship-building element: <MakeFriends>

<MakeFriends> specifies information on making friends in actual social activities. Table 3 shows the structure and information model for the <MakeFriends> element.

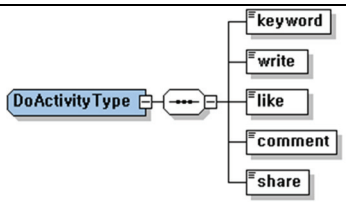
Table 3. Make Friends element and its information model

Structure	
Social activity type	<MakeFriends> is the parent element. -The parent element has no values associated with itself. -The parent element serves as container for other elements and attributes.
Elements	<MakeFriends> - It is an element defining the activity of making friends. <Keyword> is used to find preferred groups. <TargetGroup> is used to select the target groups preferred. <Participant> is used to select whether to join such groups.

• Participation activity element: <DoActivity>

<DoActivity> specifies information on multiple participation activities in actual social activities. Table 4 summarizes the structure and information model for the <DoActivity> element.

Table 4. Participation element and its information model

Structure	
Social activity type	<DoActivity> is the parent element. -The parent element has no values associated with itself. -The parent element serves as container for other elements and attributes.
Elements	<DoActivity> -It is an element defining the activity elements related to multiple social activities. <Keyword> finds targets and preferred content. <Post> supports writing activities. <Like> supports the activity of one's liking of writings, images, and videos among participants. <Comment> supports the activity of making brief comments on writings, images, and videos among participants. <Share> supports sharing activities.

The abovementioned information model related to the <SocialActivity> element is described in XML as in Table 5.

Table 5. XML expressions of social activities elements

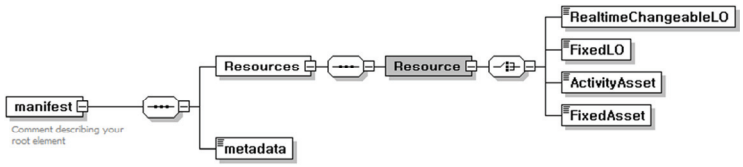
```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns="http://dm.hoseo.ac.kr/social"     xmlns:xs="http://www.w3.org/2001/XMLSchema"
 targetNamespace=http://dm.hoseo.ac.kr/social     elementFormDefault="qualified" attributeFormDefault="unqualified">
 <xs:element name="SocialActivity" type="ActivityType">
  <xs:annotation>
    <xs:documentation>Comment describing your root element</xs:documentation>
  </xs:annotation>
 </xs:element>
 <xs:complexType name="SocialActivityType">
  <xs:choice>
    <xs:element name="MakeFriends" type="MakeFriendsType"/>
    <xs:element name="DoActivity" type="DoActivityType"/>
  </xs:choice>
 </xs:complexType>
 <xs:complexType name="MakeFriendsType">
  <xs:choice>
    <xs:sequence>
      <xs:element name="keyword" type="xs:string"/>
    </xs:sequence>
    <xs:sequence>
      <xs:element name="targetGroup" type="xs:string"/>
      <xs:element name="participant" type="xs:string"/>
    </xs:sequence>
  </xs:choice>
  <xs:attribute name="type" type="xs:string"/>
 </xs:complexType>
 <xs:complexType name="DoActivityType">
  <xs:sequence>
   <xs:element name="keyword" type="xs:string"/>
   <xs:element name="write" type="xs:string"/>
   <xs:element name="like" type="xs:string"/>
   <xs:element name="comment" type="xs:string"/>
   <xs:element name="share" type="xs:string"/>
  </xs:sequence>
 </xs:complexType>
</xs:schema>
```

3.3.4 Content packaging

The package of the content model based on SNC activities is represented with the application profile, which is divided into resource content package (resource information only) and aggregation content package (resource information and structures). The resource content package is intended for the interoperability of transfers between education support systems (e.g., LOR, LCMS, LRMS) and is associated with assets and learning objects, whereas the aggregation content package is intended to be applicable to teaching and learning (e.g., LMS) and is concerned with learning objects and content.

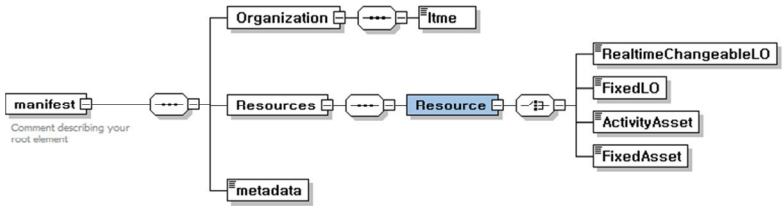
First, the resource content package consists of the learning-related resource information in Table 6.

Table 6. Application profile for resource information based on SNC activities

Structure	
Elements	<Resource> -Resource element for constructing the application profile <RealtimechangeableLO> <FixedLO> <ActivityAsset> <FixedAsset>

The aggregation content package includes the information in Table 7.

Table 7. Application profile with both resource information and structures based on SNC activities

Structure	
Elements	<Resource> -Resource element for constructing the application profile based on the structures <RealtimechangeableLO> <FixedLO> <ActivityAsset> <FixedAsset>

The proposed model supports demand for real-time content arising in SNC. This serves different purposes in addition to the original intent, enhancing reusability and contextual value of the content.

3.4 Case Study

Fig. 2. Twitter-based utilization of experts

Figure 2 illustrates an exemplary case applying the content model for SNC-based activities from Twitter to teaching-learning activities.

For example, based on content constructed with the keywords "social learning," participants in teaching-learning activities can follow, add, and communicate with their preferred experts as well as read what they have written to acquire new information or knowledge.

Currently, on Twitter, users can make friends with experts individually in diverse fields and reply, make as a favorite, or retweet for their own followers.

In the proposed model, however, an exemplary case has a learning management system transforming SNC activity elements into applicable learning objects and enabling communication with experts as intended by instructors.

Through these activities, users can engage in teaching and learning more actively and produce and share knowledge with others. Content based on SNC activities enables the real-time transmission of up-to-date information or knowledge and communication with diverse people, which would not be supported by conventional fixed content.

4. CONCLUSION

With the prevalence of the social network community and the development of social media tools enabling users to engage in the relevant activities easily and conveniently, SNC has evolved into another knowledge-sharing space where individuals produce, share, and apply content in self-directed ways. The content produced in SNC, unlike the traditional community, is upgraded in real time, encompassing the latest information and providing participants with information of value.

In this context, this study perceives SNC activities as part of a knowledge-sharing process and recognizes the content of SNC activities as knowledge resources. Furthermore, this study has put forward the SoACo Model wherein SNC activity resources are turned into learning objects applicable to teaching-learning processes.

The SoACo Model embodies SNC-based interpersonal relationships and activities in a content model and transforms real-time, changeable activities into content that facilitates the ongoing provision and renewal of up-to-date information as intended by instructors, so as to support real-time, interactive activities for participants.

The significance of the SoACo Model lies in the fact that SNC-based activities are modeled into real-time, changeable content types and can be constructed as applicable learning objects. Moreover, this study successfully applies activity elements on Twitter to teaching and learning activities as part of a case study based on the proposed model.

The developments presented in this study will underpin ongoing further studies on repurposing of content for applicable teaching-learning activities by deepening understanding of the attributes of diverse SNC content, including such content on Twitter.

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