

# A Study on Platform Development for Web 2.0-based e-Learning

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## ABSTRACT

*The new paradigm called the web 2.0 recently appeared in the web environment. We pay attention to the positive effects which may be brought about by application of the web 2.0 to e-learning; we think that it can improve problem solving skills of learners and reinforce their creativity. But until now, e-learning model, which understood the web 2.0 concept completely, has been never developed. In this context, we propose the web 2.0-based e-learning platform which induces all the courses for education such as the selection of topic, preparation of lecture schedule and contents, teaching and learning, to be decided by participants. We believe that this platform can replace or supplement the e-learning of web 1.0 age, and realize the positive effects.*

**Keywords:** Web 2.0, e-Learning, Collective Intelligence, e-Learning Platform.

## 1. INTRODUCTION

Information Technology (IT) is applied to each field of the society and especially in educational fields it has triggered the advent of e-learning. The e-learning is a system in which the education in reality is converted to an education carried out through cyber space. The range of education supported by the e-learning is considerably broad. It is applied to diverse fields such as elementary, middle and high schools, and the fields outside of schools like the education in business and life-long education for adults, covering many subjects as many as needed. Accordingly, the e-learning has become an indispensable thing to modern people and occupies a part of life.

The background on which the e-learning has spread broadly is based on the well-known positive characteristics of e-learning. For example, the e-learning secures the access to diverse education programs regardless of time and space, so it may contribute to the expansion of education opportunities for alienated strata. And the digitalized educational contents provided by e-learning systems can save costs due to repeated uses of the same contents, and it is able to expect the interactive education between instructors and learners through the network which secures the two-way communication services.

The characteristics of e-learning mentioned above may be regarded as the values created on the basis of IT as a whole.

Accordingly, the development of IT is directly connected with the development opportunities of e-learning. Especially, the recent appearance of a new paradigm called the web 2.0 in the web environment, which is one of the important IT that forms the e-learning, raises the possibility of advent of more developed e-learning. In reality, there are many cases in which the development of web has been connected to the development of e-learning. For example, the m-learning, which emphasizes the mobility in educations, came into being as web had been transferred from the fixed Internet to the mobile Internet. From this point of view, this paper is looking for the effective application of web 2.0 to the e-learning. As the e-learning was proved to have positive effects even in the so-called web 1.0 age, before the appearance of web 2.0, it is expected to bring about more positive effects in the web 2.0 age as the e-learning model will be constructed in the more advanced type.

It is planned to look into the definition and importance of the web 2.0 first, and consider the application of web 2.0 to e-learning. And then, after analyzing successful cases of the web 2.0 application, the e-learning platform, which meets the demand of web 2.0 age, will be proposed finally on the basis of the analysis results.

## 2. DEFINITION AND IMPORTANCE OF WEB 2.0

### 2.1 Definition

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Since the web appeared for the first time in the mid 1990s, the businesses based on the web had developed in the high growth rate, but the limitation of web came to the fore as the web-based businesses faced the ‘Dot-com bubble burst’. Recently the businesses that seized on the dot-com bubble burst as a turning point and constructed new web environments are appearing on the stage, showing the eye-opening progresses. Some people began to pay attention to the attempt of such businesses and explain the difference between the new attempt and the existing web as the web 2.0[1].

The Fig. 1 shows the framework of web 2.0. In this framework, we can notice that users put the contents made by themselves, their opinions, or the application that is fitted to themselves into the web. And the web produces the optimal and advanced new information by reorganizing the contents, opinions and applications put in by various people through the mechanisms, such as the recombination, filtering and syndication. And all users can identify the information produced in this manner, and if necessary, they can get different information by putting the information on the web again. Such processes are carried out by users and the infinite information can be produced continuously by repetition of the mechanism.

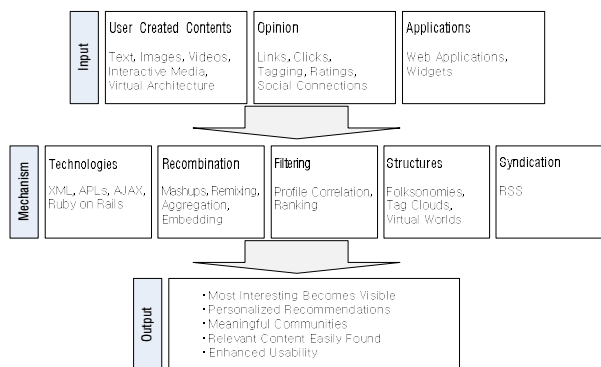


Fig. 1. Web 2.0 Framework[2]

The core conception of the web 2.0 can be summarized the ‘web as a platform’. In short, the web 2.0 is not a specific technology but a cyber space which induces the participation and sharing of users, so it help the users create and distribute information actively getting out of the passive attitude.

So, anybody can supply or demand the information and it gets the relationship between a provider and a user to be changed into the N:N status. Especially, because the web 2.0 is a concept that derived from the evolutionary process of the web, it can be applied to any field based on the Internet. And because it is possible that anybody who is able to use the web can take part in the web 2.0 system, the speed of diffusion will be high and the scale will be huge[3].

**2.2 Importance**

The importance of web 2.0 may be confirmed through the Technology Hype Cycle of the web. Technology Hype Cycle is a model that shows through what process the expectation for a new technology changes and settles down in the markets, so it becomes the index with which a maturity of an industry can be

identified.

The Fig. 2 shows a Technology Hype Cycle. Considering the periodical cycle of the web on the basis of the figure, the time, when the web appeared in the mid of 1990s, may be called the time of technology trigger. The period from the technology trigger to the early years of 2000s, when the explosive growth occurred in the web, may be called the period of peak of inflated expectation. And then, the ‘Dot-com bubble burst’ which occurred in 2004 may be called the period of trough of disillusionment.

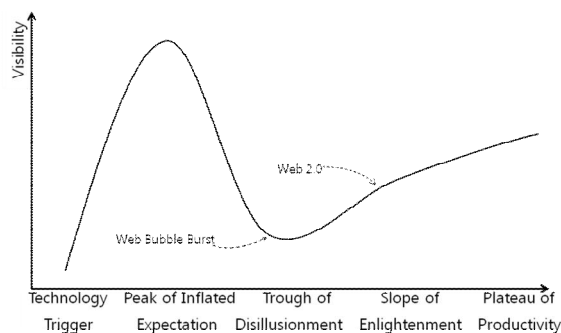


Fig. 2. Technology Hype Cycle of the Web

And the current period, in which a steady growth is occurring by means of web 2.0, may be regarded as the period of slope of enlightenment. The slope of enlightenment in the present day implies that the expectation of the early web has begun to be realized by the better condition as it is supported by web 2.0. Therefore, the web 2.0 can be the solution that may be considered to realize the potentiality of the web. In addition, the slope of enlightenment is the important basis on which the web is making progress toward the period of the plateau of productivity. Accordingly, it is within bounds to say that the key of success in the process where the web industry is developing into a matured market depends on how to accept the current web 2.0. The field of e-learning is no exception to this rule.

**3. APPLICATION OF WEB 2.0 TO E-LEARNING**

**3.1 Appropriateness**

Considering the relations between the education and web 2.0, we can imagine the methodology which raises the intellectual level on the web through the cooperation among participants, which is defined as participation and sharing. This methodology has the thread of connection with the collective intelligence. The collective intelligence stands for the knowledge that is obtained by the voluntary creation and exchange of information in the open space which anybody who wants can approach. The agora plaza in the ancient Greece can be the typical case of the collective intelligence, where the citizens were acquiring knowledge through discussions[4]. So, the space for education, which will be made by web 2.0, is expected to be a foundation where the collective intelligence is formed on-line, becoming a place similar to the agora plaza in the past.

This web 2.0-based e-learning, namely collective

intelligence-oriented e-learning, will show a big difference in terms of knowledge acquisition methodology when compared with the existing e-learning. While the existing e-learning takes on the 'Top-down' type in which the knowledge of instructor is delivered vertically to the learners, the web 2.0-based e-learning takes on the 'Bottom-up' type in which the knowledge is created by solving problems generated among learners through discussion. Accordingly, the web 2.0-based e-learning will replace the cramming education, helping improve the problem solving skills of learners and reinforce their creativity. And, when it is said that the modern students, who are called the N-generation, are accustomed to the use of the Internet and have the positive tendency of interaction through the Internet, the web 2.0-based e-learning will have a great effect[5].

On the other hand, the web 2.0-based e-learning will make progress through the interaction between an instructor and a learner or among the learners. This is a process where the ordinary majority looks for knowledge. The process like this is different from the education in the past, which was aiming at fostering small number of core competent manpower under the idea of Pareto Principle. The web 2.0-based e-learning acknowledges the potential value of individual members in the student group and emphasizes their capabilities as a whole. This phenomenon may be regarded as the realization of Long-tail Theory in education. The Long-tail Theory stands for the business activity which is focused on the remaining 80% rather than the top 20% which is designated by the Pareto Theory[6]. And the education may be individualized as the participants acquire the knowledge they want in the process of interaction, so even in this point of view the Long-tail Theory can be expected to come true. The fact that the Long-tail Theory takes place in the web 2.0-based e-learning has the significance in view of the fact that the learning effects can be expected from all the students. The web 2.0-based e-learning is no more the standardized education for a small number of students.

### 3.2 Present status of discussion

In the academic world, they just start to discuss that the web 2.0 will change the educational fields and is necessary for educational fields; they forecast that the web 2.0 will have a great effect on the evolution and innovation of education, and make every efforts to apply the web 2.0 to the educational fields. Ehlers(2008) considered that the educational value of e-learning based on the web 2.0 would be evaluated by learners and their colleagues and the e-learning based on the web 2.0 would be able to construct more individualized educational environment. And Ehlers explained that the social network would be more important than multimedia, as well as it would make the interaction with an instructor possible. As the result, Ehlers argued that the learning metaphor would be changed from the reception to the participation, and the learning process would be taken care of more importantly than the learning results. And Ehlers thought that the role of learners in the learning process would get bigger as not only the instructors but also the learners would take part in the establishment of educational planning[7].

Bessenyei(2007) evaluated the e-learning based on the web 1.0 as the technical support for the distribution of traditional knowledge merely by transferring the educational activities and

books in classrooms to the cyber space. Bessenyei argued that it was nothing but a transferring of the formalized, centralized, bureaucratic education from the classrooms to the digital environment. However, Bessenyei expected that the e-learning based on the web 2.0 environment would help users have suitable learning for themselves by choosing, organizing, distributing and controlling the knowledge on the basis of immediate demand[8]. Besides, Gan & Zhu(2007) expressed that the individualized knowledge should be dealt with on-line by constructing cyber education groups based on the web. They thought that it would be effective to collect the personal knowledge through the web 2.0 in order to solve difficult problems or display the wisdom of group[9]. Especially, Park & Shin(2008) estimated that the role of the web 2.0 would be important for the education like essay writing, where the creativity was emphasized. They argued that the student-oriented education was required, getting out of the teacher-centered instruction, so the application of web 2.0 would be inevitable[10].

Besides theses, there have been discussions that the web 2.0 should be applied to various fields of education. Franklin & Van Harmelen(2007) thought that it was desirable to carry out the formal and informal work-based and life-long education through the web 2.0. They thought it would be possible to carry out the independent, self-regulated, cooperative education and obtain an educational effect through the use of web 2.0[11]. Furthermore, estimating that IT which supports the web 2.0 reached the level where the educational effects could be generated, Ullrich et al.(2008) forecasted that the education through the web 2.0 would expand into the research activities[12].

And also, the studies in the technical aspects for the e-learning based on the web 2.0 are in progress actively. For example, the researches contain the typical developments such as the e-learning interface development and the web-delivered multimedia learning application development[13, 14]. It is expected that such technology developments will actually help realize the e-learning based on the web 2.0.

### 3.3 Required development

Considering the expected effects and attention of the academic world, the web 2.0-based e-learning shall be regarded as an important study theme. If so, what education based on the web 2.0 shall be provided? Ebner(2007) explains why the system suitable for the web 2.0, which is different from the system provided for the existing e-learning, shall be constructed for the education that will be carried out through the web 2.0[15]. We agree to Ebner's idea, and estimate that it is required to develop a new platform for the realization of new e-learning system. We are going to look for an appropriate scheme for the e-learning platform development after defining the platform as the web 2.0-based e-learning platform.

The platform we will find out will be used for any educational program by securing the diverse operability. On condition that the platform plays the role like an operational system, the various educational programs like language education, science education, essay writing education, in-house education may be applied to the platform. So, generating the economies of scope, this platform will produce a bigger utility

than the input resources for the development.

#### 4. CASEC STUDY AND IMPLICATIONS

##### 4.1 Business trends

The application of web 2.0 has been carried out in the relatively diverse business fields. Table. 1 presents the business models where the concept of web 2.0 is applied successfully. However, there is no business model which adopts the web 2.0 for education.

Table. 1. Business models which the web 2.0 is applied to

Model	Applied contents
Wikipedia ( <a href="http://www.wikipedia.org">http://www.wikipedia.org</a> )	On-line encyclopedia through participation and sharing
Naver Knowledge-iN ( <a href="http://kin.naver.com">http://kin.naver.com</a> )	Question and answers through participation and sharing
Crowd Spirit ( <a href="http://www.crowdsprit.com">http://www.crowdsprit.com</a> )	Design of electronic products through participation and sharing
Cafepress ( <a href="http://www.cafepress.com">http://www.cafepress.com</a> )	Open market where the products are manufactured and sold through participation and sharing
Cambrian House ( <a href="http://www.cambrianhouse.com">http://www.cambrianhouse.com</a> )	Developing business models through participation and sharing

The fact that there is no application case to an educational field does not necessarily mean that the application of web 2.0 to an educational field is difficult. On the contrary, the fact that the web 2.0 is applied and operated in various fields helps weigh the possibility of e-learning based on the web 2.0, so the need of early development may be confirmed.

Some researchers introduced DIGication (<http://www.digication.com>), Chinespod(<http://chinespod.com>) as the web 2.0-based e-learning, pointing out the fact that they added the discussion function or opinion exchange function to the educational course.<sup>1</sup> However, such services are no more than sharing information, and they are different from the substantial meaning of web 2.0-based e-learning, which forms the knowledge through participation and sharing. Moreover, the sharing of simple information had been already provided in the e-learning of the web 1.0 age, before the appearance of web 2.0. So, it is not correct to regard them as the genuine e-learning based on the web 2.0. As the result, it is assumed that any e-learning model, which understood the web 2.0 concept completely, has been never commercialized.

##### 4.2 Case Study

It is important to benchmark the existing cases in order to develop the web 2.0-based e-learning platform. However, as mentioned above, there is still no business model in which the web 2.0 has been applied to a complete educational field. So, from now on, it is planned to examine two cases from other

fields where the web 2.0 is applied. Even though they are not the cases immediately related to an e-learning, the characteristics of web 2.0-based model found out from the cases will provide important implications for the development of web 2.0-based e-learning platform.

##### 4.2.1 Wikipedia

Wikipedia is a compound word in which the word Wiki, which is a tool to modify web pages, and the word encyclopedia are put together. To the letter, Wikipedia is forming a knowledge warehouse by allowing users to write free articles on specific topics, and modify and share the articles. Especially, any user of web can have access to Wikipedia without special limits and participate in the system, and the contents made by the users' participation activities are dealt with equally without discrimination.

So, the information in Wikipedia stays in progressive tense. Wikipedia have a totally different production structure from that of the encyclopedias prepared by some experts in the past, but the content level of Wikipedia is so well acknowledged by academic societies as to be referred to importantly.

The basic function of Wikipedia is 'Create the page', 'Edit' and 'Search'. The function 'Create the page' is used when a user is drawing up a new content which is not currently contained in Wikipedia, so the amount of information is increasing through this activity. The function 'Edit' is used when a modification or supplement for the information, which has been posted already, is carried out, so the contents of Wikipedia get accurate and become the latest ones. And the function 'Search' is used when users find the contents of Wikipedia. If is not possible to look for the information or it is required to modify the information, the users can draw up or modify the contents through the functions of 'Create the page' or 'Edit' by themselves.

On the other hand, not all the participants of Wikipedia are ordinary people. The passionate Wikipedians, who are named Steward, Bureaucrat, Administrator, are playing roles to correct and supervise the contents, so that Wikipedia can maintain the high level of knowledge.<sup>23</sup> Of course, the activities of them are formed voluntarily, so the identity of Wikipedia is preserved.

##### 4.2.2 Naver Knowledge-iN

Naver Knowledge-iN is a service where the web users post non-specific questions and answers to the questions. Of course, the ongoing questions and answers are accumulated, so retrieving is available. On condition that a user is a registered member there will be no limit to posting questions or answering to the question, and the contents drawn up for questioning and answering are dealt with equally without discrimination. And retrieving the questions and answers is possible without membership. So, the information in Naver Knowledge-iN is accumulating continuously and naturally by voluntary participants.

The basic function of Naver Knowledge-iN is divided into

<sup>1</sup> DIGication suggests that students shall submit the assignments through on-line service at classrooms and teachers shall manage the students. Chinespod make students choose situation dramas through on-line and have discussions through on-line for the Chinese language learning.

<sup>2</sup> In some case the page stored by Wikipedia was a protected or semi-protected, a user can apply for a membership to modify the page.

<sup>3</sup> Refer to "[#Administrators.2C\\_bureaucrats\\_and\\_stewards](http://en.wikipedia.org/wiki/Wikipedia:User_access_levels)" to identify the roles of Steward, Bureaucrat, Administrator.

‘Questioning’ and ‘Answering’. The function ‘Questioning’ is allowing the user to post what he/she wants to know on the web. And the user shall choose the detailed field of his/her own question when posting. The function ‘Answering’ is to let other users provide the user, who posted the question, with the requested information. Especially, the first page of Naver Knowledge-iN is viewing the new question which is waiting for an answer as a form of public notice, so that prompt answers may be induced.

Besides the basic functions mentioned above, Naver Knowledge-iN provides supplementary functions such as ‘Writing opinions’, ‘Netizen’s choice’, and the ‘Choice of questioner’. These supplementary functions may be regarded as the tools to secure the level of information that occurred in the process of questioning and answering. For example, the function ‘Writing opinions’ makes the direction of question clear and the contents of the answer get enough by letting the third party comment on the content of the question or the answer. And it lets the user and questioner select the most correct and faithful answer among the answers prepared directly for the question, so these functions are the ‘Netizen’s choice’, and the ‘Choice of questioner’.

**4.3 Implications**

From now on, it is planned to disclose the key of success for the web 2.0 through the common characteristics which were found out in the cases of Wikipedia and Naver Knowledge-iN. This will provide the construction of web 2.0-based e-learning platform with important implications.

First, the common characteristics of Wikipedia and Naver Knowledge-iN are openness and horizontality. Anybody who wants can participate in the space of the web 2.0 at any time, and their ideas are acknowledged at the same level. For example, in the case of Wikipedia, anybody who gets access to the site is allowed to make a new content, edit it and search for other contents without special condition. In the case of Naver Knowledge-iN, it is allowed for anybody to retrieve without special conditions just like Wikipedia. And it only requests the users to apply for the membership through the minimal procedure, when they want to participate in the ‘Questioning’ and ‘Answering’. It is estimated that the openness which means the minimal participation condition is aiming at the promotion and expansion of participation by lowering the website entry barriers. Furthermore, Wikipedia and Naver Knowledge-iN are trying to make better ideas through accepting the ideas regardless whose ideas they are, and sharing the ideas-some part of ideas area added or other part of ideas are excluded-, eliminating the attitude to give priority to the idea of specific people. It is judged that the horizontality which prevents the discrimination among the ideas of participants could induce the participation as a producer, eliminating the psychological barrier in the access.

Second, the other characteristic possessed by Wikipedia and Naver Knowledge-iN in common is the self-control. They have the auxiliary functions based on the self-control principle in order to prevent the free participation and sharing from going to a wrong direction but make them produce the advanced ideas. For example, Wikipedia is defining the roles of passionate participants and supporting them in order to correct and

supervise the contents. And Naver Knowledge-iN is selecting the excellent contents and supplement them through the functions such as ‘Netizen’s choice’ and the ‘Choice of questioner’. The importance of such auxiliary functions is that these can protect the correct ideas, which can be damaged by the wrong participation and sharing on the contrary, through the participation and sharing. Especially, this self-control seems to give participants the confidence that participation and sharing may proceed in the right direction, and as the result it helps set up the virtuous circle where the active participation and sharing are taking place actually.

The openness, horizontality and the self-control confirmed above are the characteristics in common, and the biggest difference between the business models produced by the web 2.0 and the web 1.0. The business model based on the web 1.0 must have the characteristics by which the users accept the service as the operator with strong power pushes his/her own service. On the contrary, in the case of web 2.0, the power shift occurs from the operator to the users, so the business model of the users, for the users, by the users may be constructed. As the result, the operator tries to have the users’ power concentrated on his/her own business, and the operator is interested in using the users’ power for his/her business. Accordingly, the operators in the cases we have examined adopted openness, horizontality and self-control for their successful service. We think such characteristics will be required in the web 2.0-based e-learning. It is because, as explained in the previous chapter, in the web 2.0-based e-learning, the instructor or operator does not push the lecture to the learners, but the process, in which the learners set up the lecture by themselves, is thought much of.

**5. CONCEPT AND ARCHITECTURE**

**5.1 Concept**

In the previous chapter, it was identified that the openness, horizontality and the self-control were the key of success for the web 2.0-based model. In consideration of these characteristics, the concepts the web 2.0-based e-learning platform shall have are proposed as the following Table. 2.

Table. 2. Concept of the web 2.0-based e-learning platform

Detailed concept	Target
Collaborative Lecture	Platform on which any lecture topic that participants want can be served
Collaborative Contents	Platform supporting contents production
Collaborative Teaching	Platform able to play the role of instructor
Collaborative Learning	Platform able to play the role of learner
Collaborative Filtering	Platform on which the information can be filtered by participants

First, the collaborative lecture implies that any special topic is not served by platform, so anybody can discuss or decide the

topic on the basis of cooperation. This means the participants in the platform shall be assured of the right of choice of lecture topic. The collaborative contents imply that anybody can make contents through cooperation. This means the platform shall be a space where participants can make the contents directly related to lectures or references through participation and sharing. And also, the collaborative teaching and collaborative learning imply that anybody can teach and anybody can learn through cooperation. So to speak, it means that anybody can be an instructor and anybody can be a learner according to the intention of participation or sharing in the platform. Finally, the collaborative filtering implies that participants shall make the information right through cooperation. So the platform should prevent users' wrong activities which can be collective stupid phenomena, supporting the cooperation without doing any damage to the essence of web 2.0.

The above mentioned concepts, which may be abbreviated to 5C, induce all the courses for education such as the selection of topic, preparation of lecture schedule and contents, teaching and learning, to be decided by participants. This means that all the process of education is completely open in the platform, and the participants do not have a specific position, but they can take part in the education at the equal level, as a learner or as an instructor from time to time. Of course, the 5C is based on the premise that the information made in the process of education will be dealt with equally. So, the platform the 5C have been reflected on may guarantee the openness and horizontality. And the collaborative filtering, which is one of the 5C, emphasizes the participants' role in observation of wrong information. So to speak, though the information is made freely in the educational process through the openness and the horizontality, it must be assured that the openness and the horizontality are guaranteed in the process of information evaluation, so that the information may proceed toward the right direction through participation and sharing. So, this concept has a thread of connection with the self-control. After all, the 5C is considered to naturally involve all the key success factors of the web 2.0 confirmed in the previous chapter.

On the other hand, the scenario which can be forecast according to the concept of web 2.0-based e-learning platform is as follows;

First, a participant of the platform proposes a topic he/she wants to teach or learn. When the pertinent topic is adopted, the instructor group composed of one or multiple participants will be formed through discussion, who will give lectures on the topic. The instructor can make lecture schedule through the function provided by the platform, and learners who want to listen to the lecture can voluntarily participate in the lecture. But the instructor does not take charge of all parts of the lectures. The insufficient parts of the instructor's lecture may be supplemented by sharing the contents made by other participants. And the learners are not just listening to the lecture passively. As the active interaction between the instructor and learners or among learners is taking place, the problems presented in the lecture can be solved or the reference materials made by individual learners may be posted on the web through the platform. However, the case, in which participation and sharing are not sufficient in the serial process from the preparation to the end of lecture, may happen, and

also the cases, in which the instruction model, learning model or the lecture contents are standardized like elementary, middle and high school curriculum, may come about. In the former case, the third participant with professional knowledge can be designated as a mentor, and a successful operation may be induced through a minimum intervention. And in the latter case, the lecture may be put into practice immediately after eliminating the unnecessary processes such as the selection of topic or instructor, but if students are made to use this platform as an auxiliary function for learning when they solve problems or have a discussion during the learning, the effects of collective intelligence will be secured naturally during the learning process.

## 5.2 Architecture

From now on, it is planned to suggest an architecture where the concept of web 2.0-based e-learning is reflected. This architecture will play the role of guideline for the development of web 2.0-based e-learning platform.

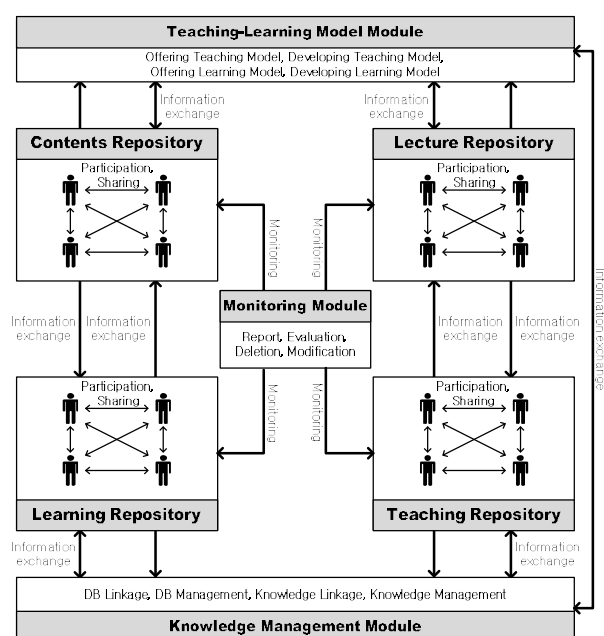


Fig. 3. Platform Architecture

The Fig. 3 is the architecture of the platform proposed by this paper. Taking a look at it, it is identified that the web 2.0-based e-learning platform is composed of 4 repositories and 3 modules. The 4 repositories are the places where the data, which is generated by participation and sharing, is stored and managed; the data is classified into categories such as the data occurring when the lecture topic is selected, the data related to production of contents, the data occurring when teaching and the data occurring when learning. When users write essays, express opinions or make multimedia materials in the platform, these data are not only stored in each repository suitable for each object, but used for education. For example, the created data through the web-page designed for preparing the education are stored in the Lecture Repository or the Contents Repository, and decided whether to be utilized for the education. Surely this decision depends on collective opinions. Also the created data

through the web-page designed for performing the education are stored in the Teaching Repository or the Learning Repository, and utilized for the education management (e.g., offering educational materials, checking up on achievement).

And the Monitoring Module is the device which carries out the deletion or modification of data that was identified to be inappropriate during the accumulation of such data. The Monitoring Module shall be operated on the basis of participants' opinions like report and evaluation. Needless to say, since the monitoring shall be based on sufficient opinions of participants, it doesn't damage the essence of web 2.0.

In addition, the stored data in the repositories by participants may not be regarded as knowledge itself, so the device which systemizes the data and develops the data into the knowledge is needed. The Knowledge Management Module takes this function. For example, when the opinions (e.g., agreement, disagreement, evaluation, revision) about data of each repository are suggested by users, the Knowledge Management Module quantitatively checks up on the knowledge level of data by these opinions, and if any data reach the high level, the Knowledge Management Module certifies the data as the knowledge, and supports the knowledge to be used for education. Also the Knowledge Management Module shall link the data stored in each repository with each other to convert the linked data to the knowledge required in the e-learning, and if necessary it shall help create another knowledge by linking a knowledge with other knowledge. This process shall be carried out under the leadership of participants (e.g., using RSS or Digg); the knowledge is made by participants and the module helps carry out the process.

An above all, in order to carry out e-learning, the frame for lectures, that is, the teaching model and the learning model are required. In the platform, this frame is provided through the Teaching-Learning Model Module. As the Teaching-Learning Model Module interacts with the repositories and the Knowledge Management Module, it provides users with the teaching model and the learning model suitable for the data and the knowledge. Also it can find the data and the knowledge suitable for the teaching model and the learning model, and presents them to users. That is, it helps the data and the knowledge fit to the direction of education. The teaching model and the learning model provided by the module do not necessarily be standardized all the time. The platform shall be able to provide each case with suitable models in consideration of the topic, lecture schedule and contents which are made and requested by participants.

## 6. CONCLUSION REMARKS AND FUTURE WORK

This study paid attention to the positive effects which may be brought about by application of web 2.0 to e-learning, and suggested a platform to realize the positive effect. The platform is established on the basis of characteristics such as the openness, horizontality and self-control, which were presented in the case study, and the 5 concepts based on the consideration of the characteristics. So, it is considered that our platform is aiming at the true web 2.0-based e-learning. If this true web 2.0-based e-learning plays the role of replacing or

supplementing the e-learning of web 1.0 age, as we discussed, it will improve the problem solving ability and creativity of learners, raise the learning participation rate of learners and provide the education that fits to the demand of individual learners.

Recently some learning management systems attempt to introduce the notion of collective intelligent (e.g., Moodle). In comparison with these existing systems, our platform is more user-oriented, and emphasized on the role of users. While the existing systems just focus on users performing the education,<sup>4</sup> our platform supports not only users performing the education but preparing the education. Also our platform gives users the right of monitoring, and provides users with the suitable teaching-learning model on demand. So we are sure that our platform is superior to the existing systems.

Finally we think that there shall be additional discussions on a few matters in order to create a sustainable workable mechanism with which our platform will be operated actually. First, it is required to prepare incentives that may induce voluntary and active participation in the e-learning. No matter how nice platform we have, it will be possible to induce the collective intelligence through the diverse processes on the platform on condition that sufficient participation of users is taking place. Accordingly, until the e-learning gets on the track, we have to stimulate the participation motives by offering incentives.

Second, the monitoring policy shall be prepared in the concrete, which does not damage the essence of web 2.0. Our platform is designating the Monitoring Module to monitor the data on the basis of participants' opinions. The level of monitoring in the platform shall be decided so as to assure the two goals at the same time, which might be put in the trade-off relations between free education and prevention of wrong education. For example, the monitoring policy must be discussed about what degree of disagreement can cause the filtering of the information and what sanction shall be applied to the user who made the wrong information.

Third, the teaching model and the learning model shall be developed. Because the educational contents and goals of the web 2.0-based education are different from that of the web 1.0-based education, the teaching model and the learning model which have been applied to the e-learning so far can not be applied to the web 2.0-based e-learning. Moreover, the teaching model and the learning model can be the guideline which supports the actual education for the positive effects. Accordingly, it is inevitable to derive the teaching model and the learning model that fit to the web 2.0-based education.

The matters mentioned above are the challenges that are occurring because the web 2.0-based e-learning is still at the early stage. We will make progress in follow-up study on these challenges from now on. The follow-up study is expected be completed through systematic and education effectiveness analysis after we carry out the demonstrative operation of the platform. And after finding the solution for the challenges mentioned above, we will carry out continuous study, concentrating on the scheme with which we can spread out the web 2.0-based e-learning.

<sup>4</sup> Refer to "http://moodle.org/" to identify Moodle.

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