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Analyzing Needs, Readiness, and Epistemological Beliefs of Students and Faculty to Implement University 2.0 as Social Platform of Teaching and Learning*

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With the advance of social technology, University 2.0 is to bring a user interactive Web 2.0 system into higher education settings, as a more powerful way of constructing and sharing knowledge. For the successful implementation of the 2.0 platform, this study investigated how faculty and students perceived this new learning system by assessing their needs, readiness, and personal epistemology at the College of Bionano. In this study, 10 students and 13 professors participated in a focus group discussion and a survey respectively, and both took an Epistemology Questionnaire. According to this study, faculty and student group expressed their opinions on issues such as academic affairs, evaluation, and copyright, and showed disparities in their epistemological proclivities. Whereas the professors had a conservative view of the students' role in knowledge creation and knowledge reproduction, the students needed a change in perception in the educational setting as well as in learning systems. This result implied that the university needs to investigate its constituents' needs, readiness, and beliefs surrounding education so that the recent participative system could effectively contribute to meeting the real needs of learners in the fields of sciences and engineering, as well as in the primary mission of the university.

Keywords: Web 2.0; University 2.0; bionano technology; epistemological belief; focus group

INTRODUCTION

THE CONCEPT OF 'WEB 2.0', since first coming to public attention in 2004, has become an excellent framework to explain the epistemological and social changes in this knowledge-based society. Even though there is criticism that Web 2.0 is a technological buzzword in the Internet industry, this one term connotes much more than mere technological advance or a trend. Web 2.0 is about amplifying the effect of social interactions between users and leading changes in the methods of knowledge construction [1]. Consequently, it is about epistemological and social changes through interactive web-platforms, making individual participation, social interaction, and collective knowledge more significant and increasing the economic and social value of knowledge.

The term 'Web 2.0' was first coined by Dale Dougherty at a conference hosted by O'Reilly and MediaLive International in 2004, while extracting common factors of the companies that survived the dot-com crisis [29]. Since then, Web 2.0 has been used to indicate a user participative mode of communication, complementing defects of one-way delivery. In short, participation, sharing, and openness are the key tripartite factors of Web 2.0 for knowledge creation and information delivery. With this communication system, anyone can take an active role in creating and distributing knowledge in the virtual network [30].

University 2.0 reflects how educational systems are adapting to these social changes. Just as knowledge creation and provision shifted from provider-led to user-participative with Web 2.0 systems, University 2.0 is an educational movement from a professor-centric hierarchical system to a learner-participative mode of knowledge creation and distribution. Owing to the increase of interactive web-using mode, learning environment and learner groups are naturally adapting to it.

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According to Kennedy *et al.* [20], the students of Melbourne University, who were under 26 not only owned various digital media tools, but were also actively using Web 2.0 technologies. In particular, they were active in reading wikis, maintaining blogs, sharing multimedia materials, viewing photos, using web conferencing, evaluating others' digital works, and managing social relationships in virtual spaces. This implies that the learners, the main constituents of higher education, are familiar with the interactive activities on the web and ready to use Web 2.0 learning systems.

In the Web 2.0 mode, students can take more active roles as knowledge creators, and a university can strengthen a more learner-participative environment. Currently, open courseware (OCW) has become popular, and web-platforms that easily incorporate this free courseware have been built online [17]. With user participative web-platforms, students can access abundant knowledge resources outside the campus and introduce them to instructors and peers. Furthermore, students take initiatives in creating knowledge by reproducing learning materials and uploading them to open web-spaces [21]. Through this on-going process, the university environment can be translated into a learning system, where social interaction can merge with the process of knowledge creation naturally. Thus, University 2.0 is a social platform for better teaching and learning. It can contribute to university teaching and learning by mediating between learners and the web environment, making use of web 2.0 functions.

Considering that the Web 2.0 system demands a high level of learners' participation on the web platform, support strategies for both learners and faculty should be strengthened for the successful application of University 2.0. Under the Web 2.0 mode, the on- and off-line environments of a university are integrated to facilitate teaching and learning. At higher education settings, offline activities cannot be separated from online activities and therefore, need to be organized in an integrated way [9]. This includes not only changing school affairs and increasing face-to-face social interaction among students and professors, but also redesigning lecture rooms and other spaces for a collaborative learning environment. For the successful implementation of these changes, identifying needs, readiness, and epistemological tendency of students and faculty is required at the early stage of designing University 2.0 system [15].

This study investigated the case of the College of Bionano at K University, a mid-sized private university in Korea, which recently adopted University 2.0 as a new mode of teaching and learning. The College of Bionano made the decision to distinguish itself from the conventional education system after considering its interdisciplinary characteristics and extensive coverage.

In this study, needs assessment and readiness analysis were conducted with epistemological consideration, in order to understand the main constituents of the College of Bionano before planning the University 2.0 system. First, identifying faculty and students' needs was required for the successful implementation of this new learning system, because University 2.0 is a social platform demanding users' voluntary participation and social dynamics. Readiness was also important to predict successful implementation of the Web 2.0 participative learning system. In particular, readiness analysis was used to investigate how well the students and faculty can adapt this new technological intervention with the appropriate level of media literacy and motivation. Personal epistemological beliefs were identified because the characteristics of Web 2.0 necessitate a deep understanding of the nature of knowledge. Personal epistemology not only deals with the belief about knowledge but can also predict how individuals interpret the Web 2.0 system and how they perform within this learning system.

UNIVERSITY 2.0 SYSTEM CONSIDERING USERS' NEEDS, READINESS, AND EPISTEMOLOGICAL BELIEFS

University 2.0 as a social platform

Web 2.0 is the interactive communication system, which is supported by technologies such as Web Feed, Open API, Mashup, CSS, and Unicode, as summarized in Table 1. As seen in Table 1, the technological features of Web 2.0 are centred on connecting people not only spontaneously but also aggregately, and facilitating users' initiative involvement in knowledge creation. In this social communication system, anyone can actively create and distribute knowledge, due to the user-centric functions in web-platforms such as tagging and recommending, using personal blogs, user-generated contents (UGC) and wikis. Consequently, individual participation is increasingly recognized in this process of mutual knowledge creation [10].

As Web 2.0 pursues collective intelligence and collaborative knowledge through participation and interaction, University 2.0 has much to capitalize on this open knowledge utilization, which is a very classic and main function of a university. However, in the University 2.0 environment, knowledge creators are not just professors, but also students, and interactions between students in social relationships are emphasized as a conducive way to learn [21]. This is definitely the most highlighted feature of this new learning platform and it is the reason that we differentiate University 2.0 from the traditional university environment. The disparate characteristics between the traditional university and University 2.0 have been compared in Table 2 with regard to direction, flow of information, role of learners, ground for interaction and supporting technology.

The University 2.0 environment closely relates to Vygotsky's pedagogical claim that human learn-

Table 1. Features and Technologies of Web 2.0

Characteristics	Main technologies	Technology features	Application examples
Sharing	Web feed (RSS, Atom)	Stresses compatibility	Instant delivery of amendments on homepage
Openness	Open API, Mashup	Creates new services	Provision of content service integration
Participation	CSS, HTML,Unicode	Adheres to norm	Service to facilitate user-participation
Collective intelligence	Tags semantic Web	Accumulates knowledge by grouping	Systemization of knowledge through intellectual web
Functions	AJAX, Flex	Strengthens users' right of choice	Changing real-time parts of a page

Note: Adapted from Hwang [16].

Table 2. Comparison between traditional university and University 2.0

Criterion	Traditional university education	University 2.0
Direction	Systematic education centred on instructors	Learning centred on the learners, Collective intelligence
Flow of information	Restricted approach	Sharing, Opening (e.g. open courseware)
Role of learner	Passive acceptance	Stress on active participation (e.g. online communities)
Ground for interaction	Offline classrooms	Offline classrooms, Online platforms
Supporting technology	Technology to distribute knowledge	Two-way interaction technology

ing and development should be mediated in sociocultural ways in human created environments such as schools, workplaces, and homes [26]. Raised for the first time by Vygotsky [44] and following others [3, 22], sociocultural development theory emphasizes that learning takes places as part of a social process and is facilitated by dynamic interactions. In this sense, the University 2.0 platform also works as a social mediation that guides learners to accessing a wider network of resources and to participating in the process of knowledge construction [18, 36]. Just as sociocultural perspective emphasizes the role of social interaction in human learning, the University 2.0 platform is designed to facilitate intellectual interaction on the Web, which enables learners to internalize the process of social participation as a learning experience [7].

This type of virtual learning platform is expected to spread more widely across universities, or in any places with a demand for education, in particular for a typical field such as bionano technology, because cyber infrastructure makes the spread of the latest ideas and applications easier and more direct. In this sense, the students in the field of bionano technology can take great advantages from the Web 2.0 mode of interactive learning system [6]. The rapid speed of development and multidisciplinary characteristic of this field require a more innovative, dynamic, and interaction-oriented approach like University 2.0 in its education in order to be able to nurture them with active collaboration and interaction skills.

Needs assessment

Needs assessment systematically investigates a problem or innovative plans, based on opinions taken from different perspectives, in order to make a wise decision [37]. As Kaufman [19] proposed, needs assessment is not only a means of planning change in an organization but also a catalyst for collaboration. By clarifying the needs of concerned groups, needs assessment drives changes based on the group members' consensus [42]. Thus, needs assessment enables investigators to consider diversified standpoints and to apply solutions to the given context [38, 45]. It also works as a channel for conversation and cooperation by assessing opinions and sharing perspectives between those who are closely concerned with the organization.

In educational settings, needs assessment is the best way to identify appropriate strategies for the successful implementation of an intervention. According to Lee and Lee [23], understanding how current members perceive a new learning system and what kind of support they demand facilitates the adoption of blended e-learning in the university environment. Furthermore, as a method of problem-solving through communication, needs assessment ultimately contributes to an member increasing participation in teaching and learning [24]. For the purpose of increasing members' participation, a focus group is commonly used at an early stage of needs assessment [4]. Initially used in market research, focus groups have gained social scientific credibility as a qualitative method. According to Morgan [27], the interactive quality of focus groups works as a source of data and insights that would be otherwise difficult to obtain. Furthermore, Basch [2] claims that a group focus is an effective method, especially when it deals with sensitive topics that may affect the members' interest and activities in society.

Readiness

Readiness is critical for predicting successful initiation and implementation of educational intervention [34]. In particular, readiness has been used to identify how well an educational group can adapt to a new technological intervention. In educational research, readiness has referred to the level of an individual's capacity to perform the learning task of a specified subject [12]. Recently, readiness for technology is studied more often in the context of higher educational institutions. For example, the study of Stokes *et al.* [41] on college students showed their state of readiness for using a web-based learning network, by measuring their level of media literacy and motivation. Caison *et al.* [5] also explored the technology readiness of nursing and medical students at a university and found that it differed in groups depending on their ages.

Epistemological beliefs

Studies on epistemological belief were initially about developmental issues in Perry [33] and its educational implication. These were followed in the 1990s by an idea of epistemology as a system of independent beliefs and the development of five dimensions resulted in a quantitative assessment approach in the Epistemological Questionnaire of Schommer [39]. Schommer's approach has established a more definite relationship between epistemology and learning, and has been used to verify that learning is influenced by personal epistemological beliefs [14].

The epistemological issue should be considered more in the Web 2.0 learning environment, because we can have a better understanding of knowledge construction when we know about the epistemological beliefs of the people concerned. According to Yang [46], a student's personal epistemology was related to their views on choosing evidence and selecting information through the Internet. How the new challenges from the growing influence from the information network affect learners would need further investigations with regard to the epistemological beliefs [14].

Eijkman [10] also interpolates the value of understanding participative characteristics in knowledge within the Web 2.0 environment in relation to epistemological viewpoints in higher education. Whereas authorized academic contents were disseminated by professors and unilaterally accepted by learners in the Web 1.0 educational system, Web 2.0 allows learners open access to a network of abundant knowledge resources and a free invitation to a virtual place for sharing each other's intellectual products. Since the value of new knowledge is authenticated by social consensus among the constituents, how students and faculty of the higher educational community view the validity of this socially constructed knowledge in the virtual network is an effective indicator for predicting the potential impact of its educational application.

METHODS

Case study of the College of Bionano Technology

In 2007, K University founded the College of Bionano Technology, recognizing bionano technology as one of the most promising fields of science. Bionano technology is a cutting edge field that manipulates, analyzes, and controls the fusion of mineral structures at the nano level [32]. Owing to its wide range of applications, bionano technology is an interdisciplinary field dealing with medicines, drugs for incurable diseases and cancer, medical equipment, data processing, energy transformations, cosmetics, and agricultural and marine products. By nature, bionano technology is a fusion technology, encompassing studies of biology, chemistry, physics, engineering and medical science [43]. From the educational point of view, the volatile and multidisciplinary nature of bionano technology demands that educators find a better way of preparing the students for future learning. Considering its promising future as a flagship technology, it is increasingly demanded that education in nanotechnology needs to equip students with abilities to interact across interdisciplinary communities and collaborate internationally [35].

The University 2.0 project for the College of Bionano Technology mainly comprises using an online web-platform for smooth inflow and outflow of knowledge, learning by active participation and social interactions, and building a supportive offline learning system (Fig. 1). The students are capable of carrying out team projects through wiki solutions, using the functions of tagging and recommending on the interactive web-platform, reproducing experiment videos for their own purposes, and uploading self-created learning materials. Researchers insist that the interactive environment and navigable interface enhance the learning experience and learning outcomes [11, 28]. Along this line, the faculties and the students in the College of Bionano Technology interact actively with insiders in the university and open their learning experience and information to the public through the web-platform. By experiencing this on-going process of collective knowledge construction, the students were expected to be more competent in the field of bionano technology.

Needs assessment and readiness analysis

The goal of needs assessment is to understand the various needs of students and professors about the 2.0 learning system at the planning stage, and to strategically make use of them in the development and implementation of the web platform. Commonly used data gathering tools for needs assessment are observations, interviews, focus groups, and surveys [37]. Focus groups have widely been used, usually in the first step of needs assessment, due to the ease in identifying the various needs of a group [4].

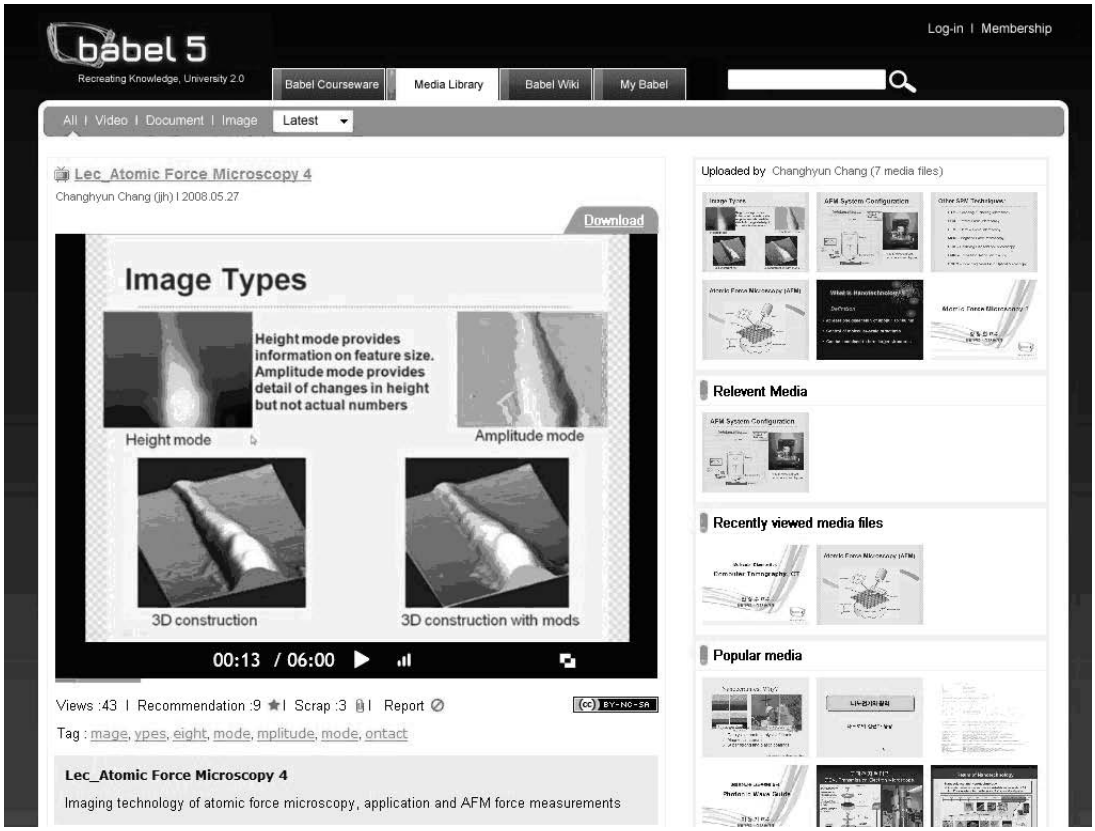

Fig. 1. Example of a page from the web platform of University 2.0.

Whereas it is generally easy to investigate the needs and expectations of a group in a short time, trained moderation and unbiased interpretation must still be overcome in this process [8]. In this study, a group of ten students who took a course in the College of Bionano Technology were asked to share their views and thoughts on the University 2.0 system. As a focus group may not be a suitable research method when individuals of a group have subtle disparity in opinions [31], we have, instead, conducted a survey with open-ended questions for faculty group.

In addition, the readiness of the students and the faculty members for the new 2.0 systems was investigated, in terms of their level of media literacy and motivation to use the web-platform in their teaching and learning.

Focus group discussion (FGD) for the students

In any given social context, decisions can be made as the result of conversations with others, and a focus group is a qualitative way of investigating people's perceptions and thoughts through open discussion, in particular among a group of 5 to 8 having similar opinions on a certain topic [31]. Through the dynamics of a focus group interview, various opinions can be collected interactively and a deeper understanding of a group's need is possible, which is the purpose of this research.

Ten students (9 male students and one female), taking an introductory course in the College of Bionano Technology, were chosen to conduct a needs assessment of the students. The individual readiness questionnaire was implemented first, followed by a focus group discussion to investigate the students' opinions of the University 2.0 system.

The session of the learners' FGD was carried out at the Institute of Teaching and Learning of K University. Just before starting the FGD, the participants answered 40 questions to determine their readiness, including attitude towards the Bionano Technology Department, use of personal

Table 3. Examples of individual readiness questions for students

Topic	Example
UGC(User-Generated Content)	*Have you produced and uploaded any UGCs on the Internet for sharing?*
Multimedia	*Have you used multimedia contents on the Internet for learning?*
Open courseware	*Have you used open courseware on the Internet for your learning?*
Wiki, Blog	*Do you use wiki or blog for uploading your thoughts or opinions?*
References from the Internet	*Do you often cite the materials on the Internet for homework?*

Table 4. Examples of open-ended questions for professors

Topic	Example
Web 2.0	*What do you define as the characteristics of Web 2.0?*
Multimedia	*How do multimedia materials affect the classes?*
Open courseware	*What is your impression on open courseware?*
Wiki, blog	*What is your evaluation of the quality of knowledge in Wikis or Blogs?*
References from the Internet	*What is your opinion about the use of the materials on the Internet for academic use?*

Table 5. Overall Scheme of the Epistemological Questionnaire and Sample items [39] results

Category of items	Dimension	*Example*
Simple knowledge	Seek single answers	*Most words have one clear meaning.*
	Avoid integration	*When I study I look for specific facts.*
Omniscient authority	Don't criticize authority	*People who challenge authority are overconfident.*
	Depend on authority	*How much a person gets out of school depends on the quality of the teacher.*
Certain knowledge	Avoid ambiguity	*I don't like movies that don t have an ending.*
	Knowledge is certain	*Scientists can ultimately get to the truth.*
Innate ability	Can't learn how to learn	*Self help books are not much help.*
	Success is unrelated to hard work	*The really smart students don' t have to work hard to do well in school.*
	Ability to learn is innate	*An expert is someone who has a special gift in some area.*
Quick learning	Learning is quick	*Successful students learn things quickly.*
	Learn first time	*Almost all the information you can learn from a textbook you will get during the first reading.*
	Concentrated effort is a waste of time	*If a person tries too hard to understand a problem, they will most likely just end up being confused.*

digital devices, degree of participation in Web 2.0 environments, and motivation for using multimedia contents for learning purposes. The students answered 'yes' or 'no,' regarding their readiness to the Web 2.0 system.

During the focus group interview session, two researchers first briefly explained the background of Web 2.0, specifically, the concept of open courseware (OCW) and detailed functions of the Web 2.0 system, and demonstrated the web-platform. The participants started their discussion and proceeded in a very natural way, and the researchers recorded the students' conversation with their permission.

After the focus group discussion, the results that were first recorded in an audio file were transcribed by the researchers. The students' ideas that they exchanged on the new learning system were classified into categories: school matters, bionano major, curriculum, courseware, and technology of the 2.0 system. The content of the focus group was triangulated with readiness questions and students' epistemology for reliability and validity [31]. According to Merriam [25], the triangulation procedure contributes not only to reliability but also to validity. Therefore, rigorous adherence to each procedure enhanced credibility, and triangulation enhanced the validity of this qualitative study result. As the results of triangulation, the semantic similarity between each individual's answers was deduced and synthesized. Each participant student's name was represented by their first initial for privacy.

Questionnaire for the professors

A survey was conducted of 13 professors at the College of Bionano Technology. Their areas of expertise varied from biochips, chemical and bio chemical sensing, bioengineering, to multi-functional nano-substance. Their average age was 34 and all of them were male. The survey consisted of 20 open questions and 20 questions asking their level of interest about Web 2.0, opinions on teaching and learning activities as well as the 2.0 learning system, and general views on the currently on-going University 2.0 project on a 5-point scale. The questionnaire was distributed and collected by e-mail with their permission.

The result of the open-ended questionnaire was also documented and categorized under core categories. The professors' needs and readiness were analysed in concerns with their answers in the questionnaire result and identified with significant semantic patterns. Meaningfully representative remarks were excerpted with the first initial of the respondent.

Personal epistemology

Based on Schommer's Epistemological Questionnaire [39], both the student and professor groups answered 63 questions. The students and the professors at the K University College of Bionano Technology answered the questionnaire with 28 items with a negative valence and 35 items with a positive valence. The questionnaire consisted of five parts:

1. Simple knowledge
2. Omniscient authority
3. Certain knowledge
4. Innate ability
5. Quick learning.

They measured what people believe about knowledge in a quantitative manner, based on their degree of agreement with each item on a scale of 1 (strongly disagree) to 5 (strongly agree).

Results on needs assessment

NEEDS ASSESSMENT FOR STUDENTS

According to the needs assessment result, students demanded a flexible evaluation system, a systematic curriculum, a learning facilitator who could help them in their group activity, and a space for open discussion for successful implementation of University 2.0 system at the College of Bionano Technology. They pointed out that the web platform should provide convenient functions, synthetically composed courseware, video clips introducing nano-particles, and practice-centred contents. Functions such as adding comments and recommendations were required as essential evaluation functions in a Web 2.0 environment. The results of the student focus group are shown in Table 6.

With regard to *school matters*, the students pointed out that the school affairs management system should be converted into one compatible for instant gathering of learners' opinions (see Table 6, A-⑦), so that it could substantially support a new curriculum and experimental facility, allowing for more individual experiences with open experiment space and a free atmosphere for discussions. In terms of an evaluation system, a more flexible and unbiased evaluation system was a requisite to increase participation of peers, learners, learning facilitators, and professors to match the vision of University 2.0 as an interactive teaching and learning system (see Table 6, A-⑤). Also, the students insisted that the staff involved in school affairs should take into consideration that the levels of lectures needed to be diversified for a wider range of choice and the curriculum needs to keep pace with the new teaching and learning system.

In terms of the *Bionano technology major*, taking into consideration the heterogeneous characteristics of the bionano technology field, the students expressed that an integrated curriculum of courses from the bachelor's level and master's level were necessary (see Table 6, B-④). In addition, the importance of publicizing the College of Bionano Technology to students, faculty members, and the public was highly recognized (see Table 6, B-⑧). These facts imply that, for successful operation of a system like University 2.0, a conducive social environment is very important.

Regarding *curriculum and courseware*, the students generally showed positive responses to what they saw through multimedia courseware. They were given an introduction to the curriculum and asked about video clips of experiments, lectures, and the study materials that were uploaded on the web platform of University 2.0. The students emphasized the importance of user-friendly design and functions (see Table 6, C-①) as well as demands for video clips (see Table 6, C-④) and a great deal of interest in their learning initiative (see Table 6. C-⑤). They pointed out that if courseware is to assist with a class or a web platform, the contents needs to be organized and arranged in an integrated way (see Table 6, D-④). Some students were very interested in a specific video clip dealing with the micro level of nano phenomenon and expected that they could take advantages of the learning materials that could make invisible nano phenomenon visible (see Table 6, D-②).

Regarding support in *technological aspects*, the students suggested that the video clips should be less than 15 minutes long, for them to be effective as a learning material (see Table 6, E-⑥). For students to be able to deftly modify media resources for their own use, they need to learn the appropriate skills (see Table 6, E-⑧). In other words, media literacy would be a decisive factor in the successful implementation of the University 2.0 system.

In addition, the participants of the focus group emphasized not only the process of learning that each person epistemologically experiences but also how to motivate learning in each individual student. As the participation of members and motivation for learning are critical in the University 2.0 system, being able to inspire their motivation, for example with a rigorous evaluation (see Table 6, A-⑤), was important.

NEEDS ASSESSMENT FOR PROFESSORS

The opinions of the 13 professors at the College of Bionano Technology were in consensus that University 2.0 project was future-oriented and that it pointed in the direction that a university should be heading. The professors commented that their aim was to realize this vision, share their missions and pursue oneness as a community.

However, they were in mutual agreement in pointing out the problems expected due to copyright issues, and the producing and teaching of high-quality teaching materials. It needs to be furnished both technically and systematically in the case of intellectual property, because 'copyright issue could be raised critically within the University 2.0 learning environment' as Professor J mentioned. In the case of bionano technology, this issue is not just an emotional one, but is also about economic value. On the other hand, the professors expected that the burdens for lectures are expected to be alleviated as the quality of course content is enhanced with the adoption of University 2.0.

Considering that College of Bionano Technology has adopted the facilitators system, the professors were expecting to mediate students and

Table 6. Student focus group results

A. School matters	B. Bionano major	C. Curriculum design	D. Courseware	E. Technology
A-① Superior students need to receive extra incentives such as scholarship and credit.	B-① Beginners find Bionano technology courses hard because of their complexity.	C-① User-friendly design and functions are critical for a curriculum to be displayed in a visually efficient way.	D-① Cyber classes are not limited by space, but they will be efficient only when complemented with some core major subjects.	E-① Students use personal digital devices for their learning in different degrees according to their motivation and enthusiasm.
A-② Facilitators have to be given authority to evaluate students according to their roles.	B-② Investment in Bionano college should be balanced with other colleges in its resources and magnitude.	C-② Bionano curriculum needs to be reorganized thoroughly.	D-② Video clips definitely help us have clear understanding of Bionano both at the micro and macro levels.	E-② The most widely used digital device should be selected for podcasting in the system.
A-③ I hope that peer evaluation result should be included.	B-③ Professors need to discuss and coordinate the content of Bionano courses.	C-③ High mutual relevance and gradual increase in intensity should be considered in planning the curriculum.	D-③ Students would be able to remember the contents of an experiment for a long time if they watched a well-made one.	E-③ I like the change toward a multimedia-based class.
A-④ A flexible evaluation system with diversified evaluating method with various evaluators is needed.	B-④ I think there should be some ways for students to learn Bionano knowledge both at undergraduate and graduate level.	C-④ Video clips on experiments should directly reflect real activities in classes.	D-④ Video clips are good visual aids in classes but only when they are effectively integrated in courses.	E-④ Using personal digital device should become mandatory.
A-⑤ Students will be highly motivated in the new learning system only when their participation is rigorously reflected in evaluation.	B-⑤ The school board needs to attempt to design course tracks that can bridge students into a more professionally specialized knowledge even as an undergraduate.	C-⑤ Students should have more chances to take initiatives in experiments than merely repeating textbook contents.	D-⑤ For a good communication with students, students need to be given enough information on the vision and missions of the project.	E-⑤ When using video clips in a class, students should be able to interact with them.
A-⑥ Practical relevance should be primarily considered in planning subjects.	B-⑥ Students with a Bionano major need to have relevant experiences and be equipped with professionalism that companies require.	C-⑥ Facilitators need to be able to read and understand material in English well.	D-⑥ Material on the web needs to be checked for quality.	E-⑥ A video clip should not last more than 5 to 10 minutes at a maximum. If it is longer, it lessens concentration and interest.
A-⑦ I hope that school board would listen to students' opinions when it comes to issues close to them.	B-⑦ Support in funding does not necessarily lead to a success story. A practical educational system and career management should be offered to students.	C-⑦ Facilitators have to check whether students watch courseware before attending classes and experiments.	D-⑦ Examples to introduce Web 2.0 should be shared.	E-⑦ If students were to take video clips themselves, it should be backed up by due facility, equipment, and support staff.
A-⑧ Those subjects of high relevance to Bionano should be included in the curriculum.	B-⑧ The school board needs to passionately publicize the new system of Bionano College through various means such as bulletin boards, a student committee, open discussion, and visual advertisements.	C-⑧ Summarizing, analysing, and criticizing are to be included so that students can have a more arduous mental activity than merely uploading content.	D-⑧ Good quality materials with a need to be openly shared.	E-⑧ I would like to take a course on UGC production.

professor between them, both academically and administratively.

> Facilitators need to bridge the gap between the professors and students in the learning process not only to convey the learners' views to faculty groups but also to lessen the faculty's workload. I also expect that, with their mediation, the average academic achievement of students will go up. They also need to monitor the faculty's teaching methods. (J)

Readiness

Readiness of the students

According to the focus group discussion, it was found that most of them were participating more actively in cyworld (a Korean social network; 9 out of 10) than in blogs (1 out of 10), suggesting that establishing a system for communal usage is the key for better utilization. While most students were making use of Wikipedia and UGC video clips, the

number of those making or uploading their own contents to Wikipedia was relatively low (5 students). As to the learning materials, use of these was extremely high (10 students), as was that of video clips and multimedia contents (9 students). However, hardly anyone had actually produced a video clip for educational purposes (1 student), or uploaded materials on a website for educational purposes (0 student).

Readiness of the professors

Regarding the faculty's readiness for a new intermediary platform, only one of the thirteen professors participated in blogs, meaning that they were hardly involved in the 2.0 activities for social interactions. However, they had a high expectation of professor–student interactions assisted by offline support from learning facilitators and learning cells. They also recommended that a continuous opinion collecting process be followed to stabilize the University 2.0 system.

Personal epistemological beliefs

Students' epistemological beliefs

For each dimension of the Epistemological Questionnaire, the result of learners in the focus group interview who showed the highest and the lowest mean value in each section was analysed to discover how different proclivities in epistemological areas affected their answers. Overall, the mean value of the students for each category was as follows, using a 5-point scale: simple knowledge (m = 2.90), omniscient authority (m = 2.98), certain knowledge (m = 3.00), innate ability (m = 2.68), and quick learning (m = 2.75).

With regard to *simple knowledge*, students had experienced using their initiative by navigating an indefinite source of information on the web. The student showing the lowest score of simple knowledge (m = 2.44) mentioned:

> It is good to search for unknown facts, thus gradually widening my realm of knowledge. (B)

Considering that the epistemological tendency for 'simple knowledge' reflects whether one believes in the definite aspect of knowledge, one's belief in infinite resource of knowledge on the web indicates how active a learner will be in the web environment.

For *omniscient authority*, students usually were highly interested in the Web 2.0 system in that it could be efficient in learning, with the acknowledgement that certain limits had to be considered for its best use. Interestingly, the more a student agreed with omniscient authority, the more they showed a limited view of the active roles of learner and Web 2.0. On the other hand, the less they perceived omniscient authority in knowledge, the more they acknowledged the involvements of learners. Student H, who had the lowest score in omniscient authority of the students showed a more practical and voluntary view:

> Web 2.0 can induce learning more efficiently in spite of some negative aspects that need to be considered before being adopted in a formal education setting. (H)

> Online learning inspires learners to manage their time, but learners should be willing to take part. In this process, a bridge between their academic goals and the current level would be helpful (H)

Through their answers to *certain knowledge,* which is their inclination towards avoiding ambiguity, students put credence on the materials on the web if they were authentically recognized by other users. The students searched Google or wiki to find trustworthy resources.

> I think I can trust the materials in wiki. The authenticity of materials is the key standard in judging a website. (B)

> I usually visit Google or other websites for homework. (S)

In regard to *quick learning*, where an individual regards learning as a spontaneous understanding or a continual progress, the instant answers on the web save time and energy for those with high quick learning tendency.

> I can find the information I need regardless of time. (L)

As shown in the personal epistemological result above, students in the focus group of study were not only aware of the efficiency of searching knowledge on the web but also how it needs to be supplemented by other systematic measures. Considering that students' perception on knowledge and learning have considerable effects on their behaviour on the web, their epistemological patterns need to be understood for the management of the University 2.0 system.

Professors' epistemological beliefs

According to the epistemological analysis combined with the professors' answers to the open questions, the professor group showed a conservative attitude toward the learner-centred mode of learning in issues such as copyright, reliability of information in the open sources, and the student's own evaluation. Overall, the professor group showed the highest epistemological scores on certain knowledge (m = 2.90) and the lowest scores on innate ability (m = 2.46). The mean score of simple knowledge was 2.63, omniscient authority was 2.82, and quick learning was 2.71.

For *omniscient authority*, one of the professors insisted that the combined characteristics of bionano technology necessitate an academic guide.

> Considering the multidisciplinary characteristics of bionano technology, it is not easy to have a broad understanding of the field without the guide of the experienced. (C)

The professors were consistently doubtful about the authenticity of students' evaluation.

> It is likely that students cannot evaluate themselves objectively. (Y)
>
> Evaluating oneself cannot be objective. (M)
>
> As students learn by themselves, they have a higher chance of reorganizing and intensifying learning at their pace. However, the authenticity, value, and level of their current academic status should be checked by professors. (J)

For *certain knowledge*, the professor group agreed that the advent of collective intellect on the web contributed to widely distributing knowledge over a short time. However, some showed amazement at the magnitude of the information, whereas others were quite doubtful about the authenticity of the material.

> I highly evaluate the quality of the materials on websites, for example, Wikipedia. Web 2.0 must be an innovative approach in learning. (K)
>
> I do trust object knowledge from authentic sources, for example those in the dictionary, but there are much more unreliable sources on the Web. (M)
>
> It is too vast. (S)

In general, the professors were conservative in their stances toward reproduced materials.

> I oppose students reusing learning materials in their homework. Creation and reproduction are not the same. (H)
>
> It is undesirable that students submit their homework by just reproducing the learning materials from class. The purpose of the original materials can be altered. (Y)

Regarding *quick learning*, one of the professors, who had the lowest score on quick learning (m = 2.33), remarked about the utility of visual materials in the class as below, showing that students must have the will to learn.

> It enhances the understanding of students with visual effects, but sometimes students just ignore what they see when they do not concentrate enough. Their will to continue learning something must be present. (J)

The results of analysing the professors' answers based on their epistemological tendency implies that they showed a somewhat conservative view toward the students' roles of knowledge constructors and evaluators, which could be critical in terms of successful application of the Web 2.0 system. Table 7 presents the results of comparing and contrasting students and faculty's needs, readiness and epistemological tendency.

As the results of this study showed, both student and faculty groups were well aware of the importance of using the digital technology network for teaching and learning. However, the level of their Internet use differed, especially in Web 2.0 based activities such as blogs and wiki. In addition, needs and readiness results were found to be in relation to their epistemological belief patterns. Whereas the students, who were positive about the openness of knowledge, were prevalently using the materials on the Internet with active interactions, the faculty members, with a greater recognition of authority, had a rather restricted view on the validity of collective knowledge on the Internet and were doubtful of the educational value of learners' self-evaluation.

Furthermore, the students needed overall changes in the curriculum and evaluation system, as well as a more interactive web platform for student-centred learning. Assistance for technology skills training was requested to overcome passive use of the digital contents on the Internet. On the other hand, the faculty group did not yet actively use the social communication system on the on-line network.

DISCUSSION

This study shows how constituents of a university recognized their different needs and readiness, with regard to personal epistemology under University 2.0—the social online platform based on Web 2.0's interactive user mode. Considering that voluntary involvement of users have shaped Web 2.0, implementing this system in a highly

Table 7. Comparison of study results between students and faculty members

		Student	Faculty
Needs assessment		Evaluation system, curriculum, and web platform more conducive to student-centred interactive learning	Protection of intellectual property, e.g. copyright
Readiness	Familiar with	Interaction with digital network and using materials of the Internet	Off-line communication
	Unfamiliar with	Taking initiatives in producing and uploading contents on the Internet	Digital-network based social interaction
Epistemological belief		Positive about open access and free participation for production	Somewhat negative about unauthorized production and distribution
		Positive about self- or peer evaluation	Authentic when professors evaluate, negative about self-evaluation
Suggestion		Assistance on software, facility, equipment, and skills training for efficient use of digital media technology	Ongoing communication to reflect their opinions on the management of digital-network based system

conservative educational setting was impossible and it was necessary to understand faculty and students' needs, readiness and epistemological tendency for knowledge.

As today's cutting edge technology is developing more rapidly than ever, the education in engineering cannot help accepting the recent trend in its knowledge creation and distribution as presented in the College of Bionano Technology, K University. Because bionano technology is multidisciplinary in nature and is changing rapidly, a new teaching and learning system in the user-based mode would be necessary. However, various needs and level of readiness were required to investigate the epistemological beliefs for the successful application of the University 2.0 project, by employing a focus group and a questionnaire in this study.

In particular, University 2.0 raises questions about its main constituents. How universities will adopt this user-focused 2.0 system advocating openness, sharing, and participation depends on how much additional effort the universities put in. According to the results of this study, most of the students and professors were familiar with using web materials for learning and research purposes. However, their activeness in categorizing, modifying, and using personal media was relatively low, which shows that both were passive in making use of their online activities with educational implications. This is the hinge point where reality shows the gap between peoples' level of awareness for Web 2.0 and their actual behaviour. The passive use of information provided by others has become common with the availability of open sources, yet it raises another challenge in developing media literacy for those who wish to overcome their digital inertia.

To be specific, based on the results of this study, the University 2.0 web platform could contribute to enhancing the quality of learning with the following changes. First, the school board needs to embed a new form of evaluation system so that the learning activities in the web-based community can be adequately assessed. Secondly, learners and professors need a certain level of digital media literacy to improve their level of participation. This could be further supported by opening facilitative workshops on campus so that both students and faculty can equip themselves with digital technology skills, which will help them advance to a higher level of participation in this multimedia driven network. Thirdly, support systems for school affairs and administration and copyright protection of original material were also indicated as key issues in implementing University 2.0. Lastly, learners need to have sufficient motivation to be a significant driving force in working the system.

As students and professors, the main constituents of a university community, inevitably have disparate views, understanding their different standpoints can help to overcome future obstacles. In order to successfully adopt University 2.0, the professors called for support at university level. For example, they demanded that more technical support assistants be available, both in and out of the class. On the other hand, students called for more fundamental changes of the system surrounding school affairs, administration and evaluation. Nevertheless, both showed constant expectation for mutual communication, yet using different mediums. The students, as savvy online communicators, were already used to network-based social interaction whereas the faculty still favoured face-to-face communication.

Epistemologically, the student and professor groups each showed unique disparities in what they believed about knowledge and learning. In general, professors cast doubt on indistinctly making use of the materials and perceived themselves as the main deliverers and evaluators of knowledge, possessing a rather conservative view about the learner-centred paradigm. Students' activeness in exploring new knowledge and constructing it into knowledge product indicated what the knowledge and learning systems in University 2.0 would need to consider in relation to each group's dominant belief about knowledge and learning.

Given that interactive accumulation of knowledge mainly constitutes the Web 2.0 system, implementing and managing University 2.0 needs a careful understanding of what the members of the community believes about the nature of knowledge and learning. Not only does a new evaluation of the learning capabilities of the students on the web need to be adopted, but also finding an innovative method to structure the system to be more conducive to learning is yet another challenge that University 2.0 has to overcome.

University has been a fortress of knowledge that had its own rules and powers that not many other social parties have easily violated. Yet, in the Web 2.0 trend, another innovative wave for information and knowledge is raising a fundamental question on the unscathed authority of the academia. The Web 2.0 trend, motivated by free open sources, sharing, and self-production of contents, seems to be threatening the authority of the traditional higher educational system; it originally reflects the aims of higher education, the dissemination of knowledge. Therefore, its further use in higher education would need to be accompanied by updated 'academic protocols, for assessment and publication' that would result in 'legitimation and scholary and scientific recognition for critically rigorous work that they express in such forms' [13].

As this qualitative approach is aimed at describing the current needs, readiness, and the epistemological beliefs of students and faculty, especially regarding the use of a web platform featuring Web 2.0 characteristics in the current administrative system, the interpretation of the results beyond this study context is limited. Nevertheless, since bionano technology is not only leading the cross-over collaboration of the science and technology community but is also expected to keep demanding

interdisciplinary research, these investigations would have helpful implications in the engineering education for bionano technology in adopting other new types of social interaction platforms. Further research on faculty and students' needs for technological and educational assistance on using this kind of web interaction platform, readiness for digital media literacy, and a more complete survey into their epistemological beliefs would be illuminating. The engineering education for bionano technology definitely needs a robust, flexible, and open platform on the Internet in order to facilitate sharing, collecting and reproducing knowledge. With this new web platform, learners in the field of bionano technology can keep up with the rapid change in a very autonomous way.

Web 2.0 reflects the dominant mode of interaction and mutual production of knowledge on the Internet but, as found in this study, some faculty members only limitedly acknowledge its benefits for their students' learning and students also need educated guidance for its meaningful use. Whether the students and professors will perceive each other as partners in creating useful knowledge or remain in their conventional roles will paramountly affect its influence in the near future.

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