

# Proposal of an Instructional Design Support System Based on Consensus Among Academic Staff and Students

Shuya Nakamura<sup>1</sup>(✉), Takahito Tomoto<sup>2</sup>, and Takako Akakura<sup>3</sup>

<sup>1</sup> Graduate School of Engineering, Tokyo University of Science,  
1-3 Kagurazaka, Shinjuku-Ku, Tokyo 162-8601, Japan  
nakamura\_shuya@ms.kagu.tus.ac.jp

<sup>2</sup> Graduate School of Engineering, Tokyo Polytechnic University,  
1583 iiyama, Atsugi-Shi, Kanagawa 243-0297, Japan  
t.tomoto@cs.t-kougei.ac.jp

<sup>3</sup> Graduate School of Engineering, Tokyo University of Science,  
1-3 Kagurazaka, Shinjuku-Ku, Tokyo 162-8601, Japan  
akakura@ms.kagu.tus.ac.jp

**Abstract.** In this paper, we propose an instructional design-based method for supporting academic staff and students in value co-creation within the university setting. The term co-creation adopted in this study comes from the field of service engineering and is defined as the mutual creation of value by service providers and service beneficiaries. Co-creation is realized by consensus among them. Within the university setting, the service providers are the academic staff and the beneficiaries are students. Here, we propose a model of co-creation in universities and then present a support method based on a syllabus and learning motivation for co-creation. Finally, we discuss the co-creation support system.

**Keywords:** Instructional design · Co-creation · Service engineering

## 1 Introduction

In this paper, we discuss a model of co-creation and a co-creation support system within the university setting on the basis of instructional design. In recent years, Japanese universities have been required to improve education according to the social background of students. The declining birthrate has led to the coining of the phrase *daigaku zen'nyū jidai* (era of open university admissions). With declining enrollment, it is becoming difficult to manage universities. However, making entrance examinations easier to attract more students lowers the quality of higher education institutions. Therefore, universities need a way to respond to the needs of society while maintaining the quality of education. To do so, instructional design based on the needs of the students is useful, but this approach can be difficult because the academic staff at universities is often composed of researchers rather than professional educators. In this study, we apply the concept of co-creation from service engineering and propose a model of co-creation within the university setting. Then, a support method is designed to share the needs of students and academic staff. We conclude with a discussion of the support system for implementing instructional design considering the quality of education.

## 2 Co-creation

Co-creation is an important concept in service engineering. It is possible to measure the productivity improvement and efficiency of services to be provided. Our aim is to improve the service quality of university instruction. Toward this end, it is important to have not only the efforts of service providers but also the cooperation of service beneficiaries. Co-creation is realized through the actions of both providers and beneficiaries, facilitated by the perceived value of service. The perception of value requires self-reflection. Perception of the value of service and mutual efforts to create the value leads to ideal providers, ideal beneficiaries, and ideal services (see Fig. 1) [1].

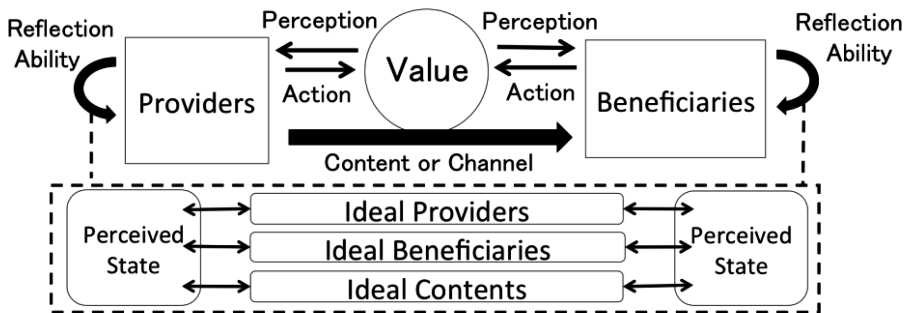


Fig. 1. Co-creation

Here, we treat university education as a service. We regard academic staff as service providers and students as service beneficiaries. The academic staff now must provide instruction in increasingly specialized subjects to satisfy the requirement of maintaining the value of education. In other words, academic staff and students must respond to the needs of society. To maintain the value of education, academic staff and students need to act perceiving the ideal academic staff, ideal students and ideal education. In this paper, we define the ability of students for understanding the needs of society as “literacy,” and the ability of academic staff for meeting the need of society and students as “competency”. We consider that education with high value is made possible by the academic staff’s competency and the student’s literacy. One purpose of the proposed system is to clarify the mechanism of service provision in education using the concepts of competency and literacy.

## 3 Proposed Method

In this section, we describe the proposed method of instructional design support. To realize courses where co-creation can be performed, academic staff must suggest an educational plan for students. We consider it necessary for students to confirm and understand the plan before they join the course. We define such confirmation as *consensus*. Academic staff and students form the consensus, and then they join the course and together assess whether they can achieve the goal of the course. In the next lesson, academic staff determines the educational approach utilizing the assessment

results. Then the assessment is performed again. The model is shown in Fig. 2. We describe the instructional design support method based on this model.

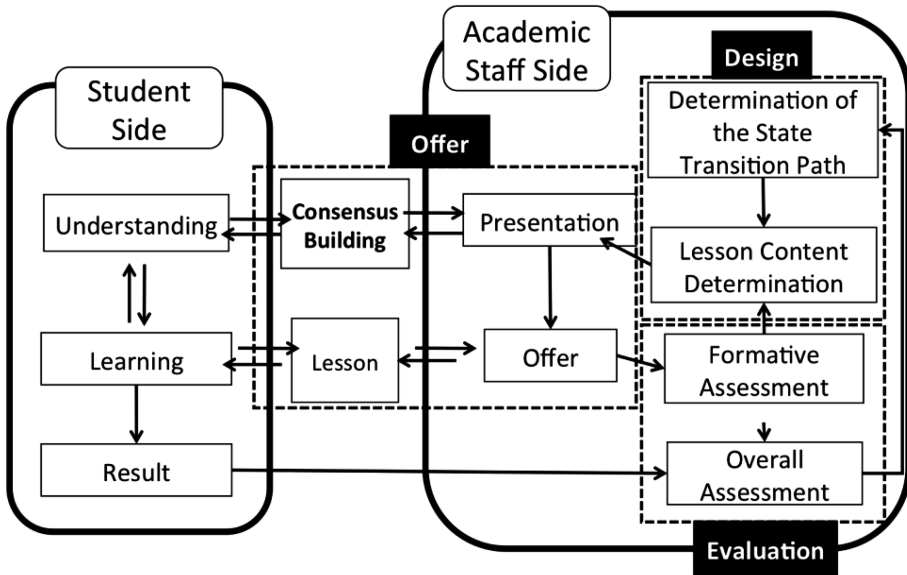


Fig. 2. Model of consensus among student and academic staff

### 3.1 Syllabus

A *syllabus* is often used for instructional design at universities. It is a useful tool for giving an overview of a course and indicating its purpose. The syllabus plays a significant role in teaching. Many universities publish syllabuses on the Internet. There are several studies to arrange for crossing search [2]. Syllabuses provide students with useful information and help them make a comparison of a subject between universities.

The contents of a syllabus are as follows [3]: course name, academic staff name, undergraduate department, grade level, number of units, time, place, textbooks, reference books, teaching goals, lesson plans, and evaluation methods. At many universities, the rules and form of syllabuses are assessed for ease of understanding. Students can obtain an overview of the course and understand its flow. However, the syllabus is currently made by only academic staff. Therefore, it could be insufficient for meeting the needs of students.

We suggest the syllabus as a material for sharing educational goals among teachers and students. For co-creation, it is most important to share the value of the course. Yet the value is usually invisible. We consider the syllabus to serve as a visible material for sharing co-created value. Academic staff should systematically conduct courses. Then, they can reflect on one lesson and make improvements for the next. To improve a course systematically, academic staff needs to recognize the relation between the purpose of the course and its content. For this, it is necessary to gradually divide the purpose into several sub-goals. The relation between concrete sub-goals and contents is clear. Therefore, it is easy to share consensus among academic staff and students. In the

next subsection, we explain the method for dividing the course’s purpose into sub-goals based on Hayashi et al. [5].

### 3.2 Details of the Lesson Plan

The syllabus is a written education plan. And typically covers a total of 15 lessons for a university course. The educational goals of a course can be achieved by achieving the teaching objectives in each of the course’s lessons. To achieve a lesson goal, students must acquire the targeted knowledge and abilities. Giving students a means of checking the acquisition of the required knowledge and abilities in the lesson will facilitate consensus building among academic staff and students in the course. Figure 3 shows an example of a detailed syllabus. Here, the course is composed of 15 lessons. In each lesson, learning contents are described, as are the methods for acquiring knowledge and abilities. Providing the descriptions from the syllabus after each lesson is effective because it is an adequate method for assessing the status of the previous lesson. However, it is difficult for academic staff to construct a dynamic syllabus. Hayashi and Mizoguchi [5] propose a methodology for constructing an adequate pedagogy based on ontology. We use the methodology for co-creation. After a lesson, academic staff and students create the syllabus together. By this action, they understand and share the value of contents.

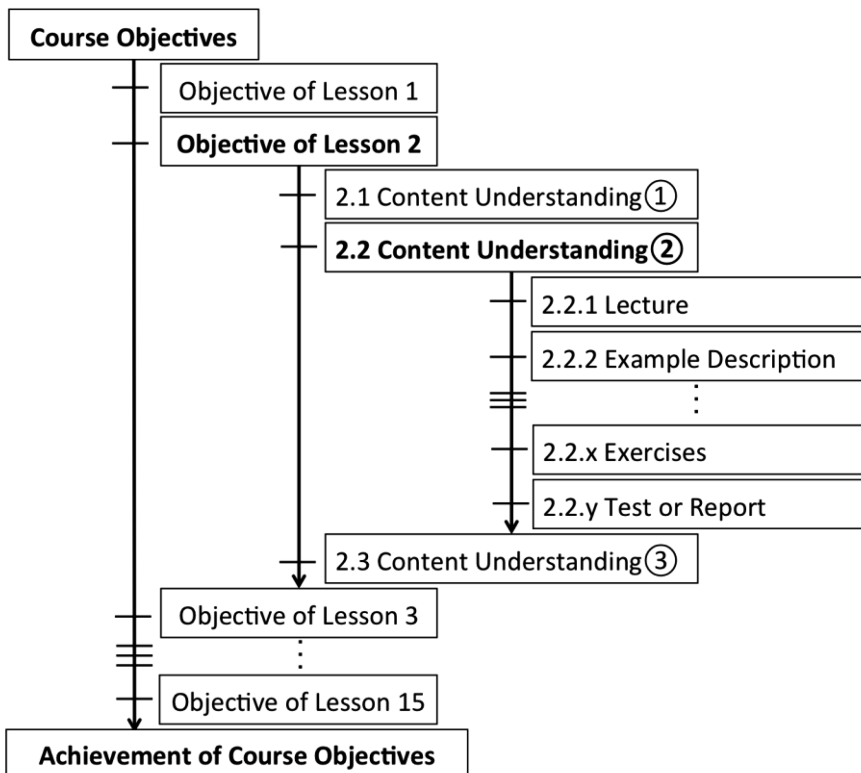


Fig. 3. Details of the syllabus

### 3.3 Method for Learning Motivation

Even if the relation between sub-goal and contents is made clear, it has no value without the motivation of students. For co-creation, action by students is necessary. In this subsection, we propose a method for improving the motivation of students. In a typical class, there are some students with low motivation students and others with high motivation. Therefore, academic staff must be able to identify the students with low motivation and increase their motivation. There are two way to determine a student's motivation. One is assessment by a questionnaire. Another is observation of the student's behavior during class. In co-creation, gaps in perception between academic staff and students are an issue. For example, if a teacher assesses a student as having low motivation even though the student studies hard, then it could lead to a drop in motivation. Therefore, we investigated whether there is a gap in the assessment of motivation between academic staff and students [4]. Figure 4 shows the results of assessment by academic staff for motivation (scored as high or low). Six factors were associated with an assessment of high motivation (Class participation without prompting, Course content pointed out, Reaction, Performance, Active communication, Seat position). Two factors were associated with an assessment of low motivation (Nonparticipation, Use of electronic devices). These eight factors were composed of several elements. From this cause-and-effect diagram, students can see how academic staff assesses their behavior.

We propose a method based on collected motivation data. We quantitatively evaluate the motivation of students based on previous research [4]. Also, we evaluate the differences of the elements between students. Then we can motivate a given student by pointing out the behavior of a similar but better motivated student. For example, suppose students A and B are similar but student B often asks the teacher questions. Then, we suggest to student A, "Let's ask the teacher a question!" We call the depiction of this transition the *learning state map*.

In addition, we can use the collected motivation data for cluster analysis. Academic staff can ascertain the characteristics of students and motivate them.

### 3.4 Consensus Procedure

Figure 5 shows an overview of our method. The academic staff creates a detailed lesson plan based on the syllabus before the first round of classes. Students attend a class after they have reviewed the lesson plan. After the class, they are given a questionnaire and a test for understanding of learning motivation. Depending on the survey results and discretion of the academic staff, the learning state map is updated. By assessing difference between high motivation students and low motivation ones and updating learning state map, academic staff and students can obtain how the students maintain the learning motivation. Nakamura et al. [4] has examined awareness among academic staff of student learning motivation in class. "Factors" representing student characteristics constitute the middle bone of a fishbone diagram. "Causes" of concrete improvement constitute the small bones. Before the next lesson the details of the next teaching methods are presented for learning motivation. We consider that the possible consensus can be expanded by repeating this process.

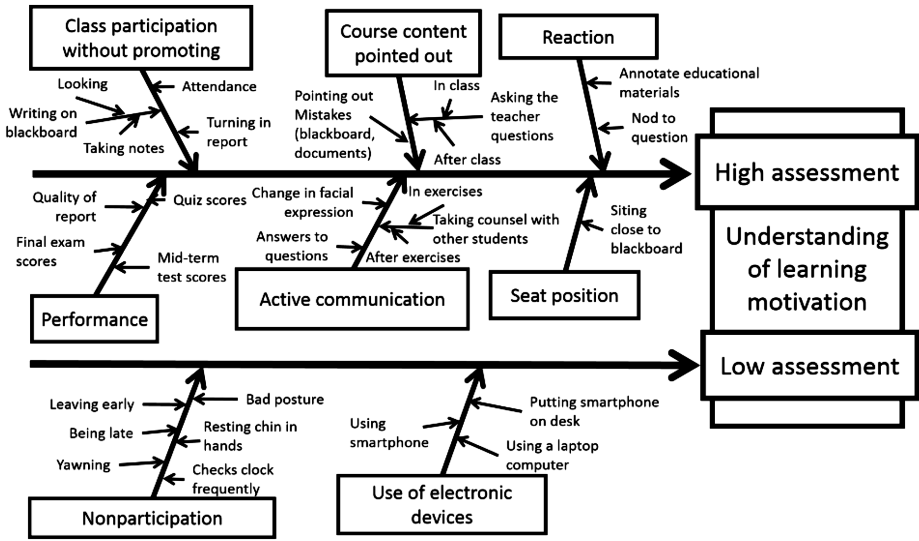


Fig. 4. Factors considered by academic staff regarding student motivation in the class model

## 4 Support System

In this section, we describe the design of a support system for the proposed method. The system requires the following five functions.

1. Support for refining the syllabus and to design lesson plan.
2. Support for inputting item about learning motivation.
3. Automatic updating of the learning state map of each student and each group categorized by cluster analysis.
4. Generating transitions in the learning state map for each student, each group and academic staff.
5. Sharing of and referral to various types of collected data.

The first function is implemented based on previous research [5]. The second function is realized by inputting data. Students report their motivation in questionnaires. Academic staff assesses student motivation by observation. By third function, the system derives the learning state based on collected motivation data according to previous research [4] and displays the learning state map about individual learner and specified group by cluster analysis. In the fourth function, the system provides information to students and academic staff for improving student motivation. Academic staff and students can see data on changes in learning motivation on the server. Also, students can feel the value of the class and of their own growth. These functions create consensus and support co-creation (Figs. 5 and 6).

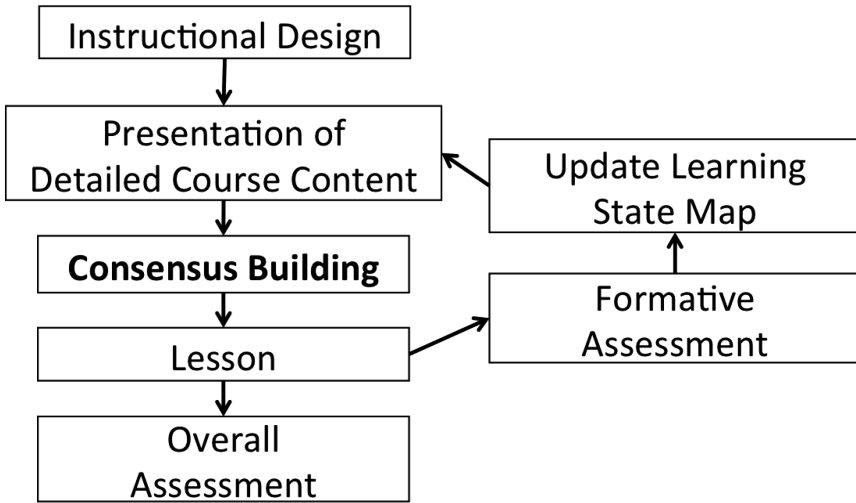


Fig. 5. Consensus procedure

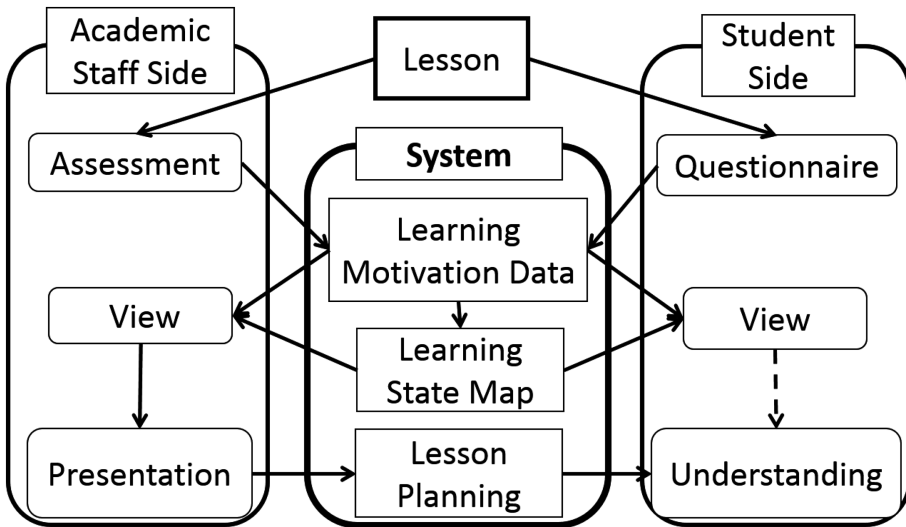


Fig. 6. Consensus procedure

## 5 Conclusions and Future Work

In this paper, we proposed a model, a method, and a support system for co-creation within the university setting. Consensus is most important concept for co-creation, but it is invisible and difficult to share. We consider the syllabus to be useful tool for the sharing of learning content and a means for acquisition of required knowledge and abilities. In addition, we suggested a learning state map based on a cause-and-effect

diagram from previous research. This map enables sharing of students' learning motivation and means of improve. We also designed the support system based on the proposed method. Here we considered only lesson content and student motivation. In the future work, we should discuss knowledge and abilities of students. The production is important for sharing the value of a course. Then, we plan to implement the support system and evaluate it.

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## References

1. Shimomura, H.: Development of implementation of co-creation value by improving the higher education and providers of competency that target beneficiaries literacy. Service Science, Solutions and Foundation Integrated Research Program. <http://www.ristex.jp/servicescience/project/2013/03/>
2. Kawaba, T., Tsuchiya, T., Koyanagi, K.: Development of universal web syllabus system. *Jpn. J Educ. Technol.* **35**, 61–64 (2011)
3. Ministry of Education, Culture, Sports, Science and Technology.: For reform situation such as educational content in University (Overview). Office for University Reform. [http://www.mext.go.jp/a\\_menu/koutou/daigaku/04052801/\\_icsFiles/afieldfile/2014/11/18/1353488\\_1.pdf](http://www.mext.go.jp/a_menu/koutou/daigaku/04052801/_icsFiles/afieldfile/2014/11/18/1353488_1.pdf)
4. Nakamura, S., Tomoto, T., Akakura, T.: Consciousness of academic staff about motivation of students in class. In: IEICE General Conference 2015, p. 210 (2015)
5. Hayashi, Y., Mizoguchi, R.: Lesson planning by reuse of practical expertise in teaching strategies. In: Proceedings of the Annual Conference of JSAI 28, pp. 1–4 (2014)