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Value Co-Creation in the Tunnel Engineering Course Design and Implementation

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ABSTRACT

To meet the requirements of the new curriculum, the syllabus of the course Tunnel Engineering is revised accordingly, with value co-creation in learning and teaching under consideration. The course design and implementation plan development are led by a staff group, but founded on the features and basic requirement of the course, in terms of professional capacity, and the knowledge background and intentions of the students. The effect and results of the value co-creation in learning and teaching plan implementation are evaluated with the consonance and resonance effects of the interaction between the students and the instructors, and the course implementation plan is accordingly tuned to inspire and guide students to become self-directed and critical thinkers. The experience shows that as the student-staff partnership frameworks are of features, of course, own working context, a viable value co-creation approach in the learning and teaching process can make the education flexible and effective, and beneficial to all of the active participants.

Keywords: Value co-creation, learning and teaching, course design and implementation, Tunnel Engineering

1. INTRODUCTION

We are in a quickly changing world and high education is generally much susceptible to the global background. In order to meet the requirements of the times, the major curriculum at a university needs adjusting in time. For professional teachers, one of the challengeable tasks is to design and develop an inclusive and viable syllabus, with enough flexibility to the changing situation. Under these situations, education should be student-centred and the course design and implementation plan are service-oriented. In responding to the situation, it has been always attracting attention to improving teaching effectiveness, such as in terms of conceptualizing the learning and teaching process holistically and specifying the process in particular contexts [1]. The interest in student-instructor partnership in higher education is growing in recent years [2, 3]. Co-created learning and teaching may offer a chance to make the education flexible [2], provided that the partnership frameworks are features of our own working context. As activities are student-centred, well-designed course content and implementation environment can engage students to become self-directed and critical thinkers, and help students to bridge the gap between textbooks and scientific problem [4].

The practice of co-created curricula in higher education [5] implied that information sharing is vital to interaction and co-creation [6], and feedback gives the chance of taking student's views seriously. The interaction should start in the course development, such as through student-teacher team work [7]. During the course plan implementation, the effective participation of the whole class is beneficial and important to the co-creation in learning and teaching [8].

Similarly, student-centred approach can be effective for learning and teaching in large classes and helpful to improve student's cognitive and practical abilities [9].

To meet the requirements of the new curriculum, the syllabus of the course Tunnel Engineering at Chang'an University is revised accordingly, with value co-creation in learning and teaching process under consideration. We argue that applying value co-creation principles in the course design and plan implementation, in terms of course content choosing, interaction between students and staffs, effect evaluation.

2. BACKGROUND

2.1. Situation in General

In recent years, we see old industries fade and new industries emerge. The situation is challengeable. On the other hand, efficient and convenient infrastructures are necessary for the new times. Tunnel Engineering is not a new subject in the field of civil engineering. As a professional course, the situation is also challengeable, in terms, of course, preparation and implementation. The course design is confined by the general situation of the curriculum, which is dynamic and to be revised to meet the social and industrial requirements, as shown in Fig. 1. As we add what is needed into the curriculum, the courses out of date are removed. Some are expanded while others are reduced, in terms of time and resource allocations.

Under this competitive and challengeable situation (Fig. 1), the syllabus of the course Tunnel Engineering at Chang'an University is accordingly revised to be coordinated with

the whole curriculum. For example, the course time is generally decreasing with time (Fig. 2). However, as a course presenting tunnel and underground structures knowledge and professional skills, the basic requirements are the same as that of the previous years, not to mention constantly added new contents with the development of the engineering in practice. Although it seems hard and time taking to practice a new way in learning and teaching, such as due to the time and regulatory constraints faced in planning new teaching approach [5], the course design and plan implementation should be improved to get with this dynamic and challengeable situation.
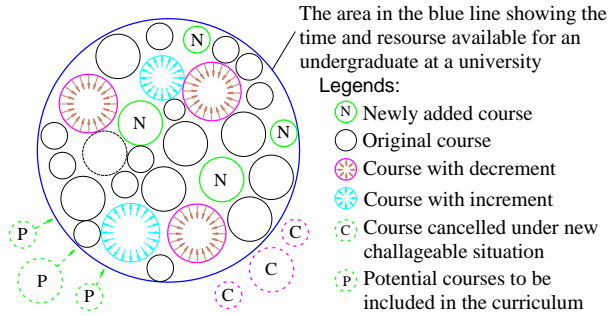

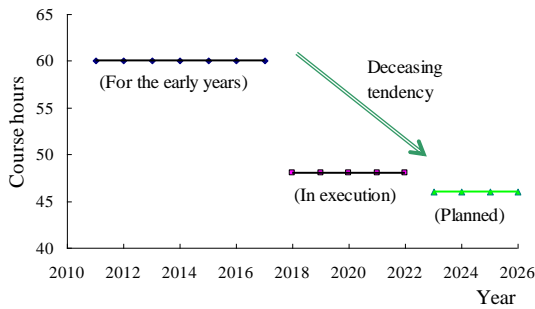**Figure 1.** The competitive and challengeable situation of the courses in a university curriculum

Figure 2. The decreasing tendency of the course hours for Tunnel Engineering at Chang'an University

2.2. Value Co-creation in Course Design and Implementation

A university provides service as a basis of information and knowledge transferring and innovating. Considering there are various ways to obtain information, we course instructors need to focus on services, not just present knowledge. The teaching activity is therefore a service-dominant procedure. This means that a well-designed course should be inclusive of services and service culture. In this context, the productivity of the learning and teaching depends upon the effect of co-creation between the students and instructors, especially the engagement of students and their active participation in the information transferring and innovating. Indeed, the results of the value co-creation in a course execution will be defined by the effective performance of the emergent interactions [10] in

teaching and learning. In a student-centred learning and teaching process, interaction is necessary and value co-creation lives on information sharing [6]. But the interaction and value co-creation in learning and teaching procedure is affected by the information asymmetry [11].

2.2.1. Features of value co-creation required

In learning and teaching activities, the participation in value co-creation could be as cognitive and behavioural [12]. Considering that not all students are likely to engage in these behavioural activities, performing, such as the cognitive dimension of interaction through self-generated activities [12], is part of co-creation [11]. For the course with more students involved, we assume that the cognitive dimension of interaction could be much beneficial way, especially in reading and reviewing.

To realize value co-creation, students' ability to create value is a key factor. The ability is based on the amount of information, knowledge, skills and other operant resources available. Knowledge endowment is more fundamental to student's ability since more information is not always better [13] while knowledge is generally relevant [11]. Learning and teaching activity is a multi-actor context procedure. We should start from information sharing, through knowledge sharing, and shift to value co-creation.

In a student-cantered or a service-dominant learning and teaching activity, co-creation can be affected by cognitive problems, which are closely related to the features of the students' subjectivity, such as views, perspectives and expectations. The co-creation is context dependent and emergent, which means the features of process dynamics, and the procedure and its outcome are emergent [10]. Thus, information and knowledge sharing and the interactions between students and instructors are vital to the revising and tuning of the value co-creation procedure.

In a value co-creation process, each actor contributes to the creation of value through pursuing goals in harmony to the same process, though there may be multiple goals, contexts and of dynamic features, in terms of process and created values [10]. The active engagement of all actors, especially teamwork and interaction, are vital to the effectiveness of the value co-creation in learning and teaching process.

2.2.2. Evaluation of value co-creation

According to the information variety model [10], the key factors in determining the process and outcomes of interaction between students and instructors involved in a viable system are the effectiveness of consonance and resonance in the learning and teaching interaction. Because value co-creation cannot be standardized [10], it is rather subjective, time sensible, contextual, and can be affected by personal culture and intentions. Considering the features of diversity of the personal culture background and goals, it seems impossible to avoid conflicting in

views of actors involved. However, this offers a potential source of innovation in the interaction procedure.

The value generation processes depend on the relevance of the system's capability to develop an adequate level of consonance and resonance [11] in an interaction process, such as in terms of context. Actors achieve their goals by participating in the process and the results of the interaction are determined by the consonance of the actors. A consonance, built upon entities and context, becomes resonance, and consonance degree can be measured as [11]: "*a big variation of information variety as an effect of a little interaction, denotes a high consonance; a low variation of information variety as an effect of a big interaction, denotes a low consonance.*" In simplicity, resonance presents the possibility for interaction to become more effective [11]. In sum, the viability of the value co-creation in learning and teaching procedure mainly depends on the capability of effectively pursuing actor's goals and generating resonance through the interaction between the involvers in the procedure.

3. COURSE DESIGN AND IMPLEMENTATION

To make learning and teaching procedures effective and being in line with the requirements of the times, the course Tunnel Engineering is designed and implemented with special reference to value co-creation.

3.1. Considerations in Course Design

As above mentioned, the value co-creation in the learning and teaching process is context related, such as in terms of information varieties and the personal way of perceiving. In the course Tunnel Engineering design, the main points include course features and basic requirements, students and staff's intentions and performance.

3.1.1. Course features and basic requirement

The course time is decreasing (Fig. 2), but the information and materials available for course preparation are increasing, thanks to the practices in complex infrastructure projects. On the other hand, the requirements for professional course learning and teaching are increasing since more complex infrastructure projects will be built with more effective approaches in the future. These are the basic course requirements of Tunnel Engineering.

The course information sampling depends on the basic content of Tunnel Engineering as a subject, including the planning, design, construction, operation and management of a tunnel or underground structure. Of the course features, we should consider that a large tunnel project is always a complex system [14]. The performance of a project is related to various factors (Fig. 3), including the

features of the tunnel structure, construction and environment confinement, being considered in tunnel planning and design. For the factors under consideration, several co-dependent parameters will influence their natures [15]. The related concepts, techniques, principles and theories could be systematically used in the course learning and teaching process.
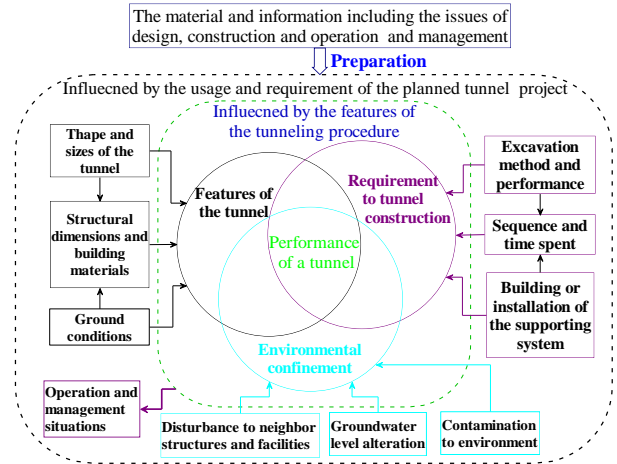

Figure 3. The course information sampling with the consideration of tunnel performance and related factors

3.1.2. Student's intentions and performance

It is vital to present students' learning intentions in a proper way, since the effect of value co-creation in the course learning and teaching process are closely related to the student's views, perspectives and expectations on the process. Considering the co-creation is context dependent and emergent [10], student's intentions are expressed at the beginning of the course information preparation, such as through discussing, together with staff, on the content of the learning information and materials, analyzing the responding information and feedback from the previous semesters. Focusing on student's knowledge background and interests, we interview students to participate in course learning and the instructors of the closely related fundamental disciplines, to determine the prioritized areas for the course design and implementation.

3.1.3. Staff's intentions and performance

The staff's main intentions are to present the basic information, principles and theories of the course effectively, and guide the students focusing on their professional interest. In general, staff's intentions are the starting points of the course design, since they well know the course features and basic requirement. At first, we decide the prioritized areas for the information preparation and let the team staff to develop the additional information and materials for expansion reading and case studies, according to their own expertise and experiences.

However, the staff's main intentions need evaluating in both the course design and implementation stages. One of the approaches to evaluate whether the staff's intentions proper or not to the students is to analyze the responding information from the students in the two corresponding stages. Indeed, the effect of staff's performance checks their intentions. Active interaction and responding from students imply good performance. Student's innovation and interest in course related professional points are the praise of staff's good performance.

3.1.4. Influence of information asymmetry

The problem due to information asymmetry can lead to uncertainty in the interaction between the students and staff [11], especially at the early stage of course design and implementation. For example, at the early stage, students have inadequate information to relate the knowledge points to particular engineering facts, such as construction procedure or design principle. One of the strategies to reduce the influence of the information asymmetry is to make the course design and development being service oriented, as well as to make the benefits of knowledge or information easily available. Student-staff partnerships in learning and teaching are a way of moving towards a more human, relational higher education [3]. As the course information is early open to students, the interaction between students and staffs can extend our understandings and make our practice to be constructively critical. Thus we can get the benefits of partnership through evaluating our practice in time. The practice of co-created curricula in higher education [5] implied that information sharing and feedback give the chance of taking students' views seriously. Then instructors can take an early course design decision, as well as revising or improving during plan implementation. This is useful to improve the viability and effect of the planned co-creating curricula.

3.2. Design and Implementation

3.2.1. Course design and development

With the above factors under consideration, the course syllabus is accordingly revised and implementation plan with specified information and materials is developed, through student-staff partnership and staff team work. Fig. 4 presents the process of information sampling for the course content, with tunnel structure features (Fig. 3) and the value co-creation development process in course plan implementation under consideration. For instance, actors first subjectively perceive the variety items (information or resources) and select some of them as resources; the selected variety items are filtered or analysed and made them meet specified requirements [10]. In this process, the effect of value co-creation depends on the viability of the

interaction between students and staffs, and on the flexibility of the specified categorical values.
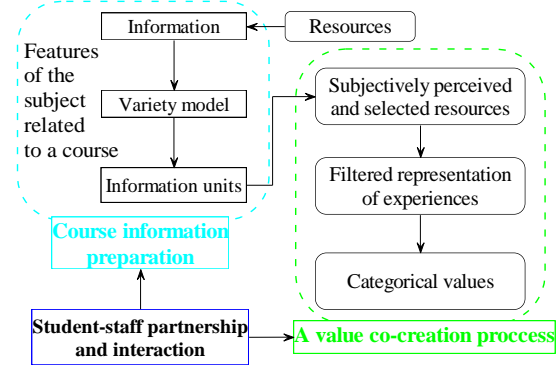

Figure 4. The information sampling in course design and value co-creation in implementation process

The basic requirement of the course and the interaction between students and staffs during course syllabus design and content development, as well as in the learning and teaching plan execution is sketched in Fig. 5, with their intentions and performance under consideration.
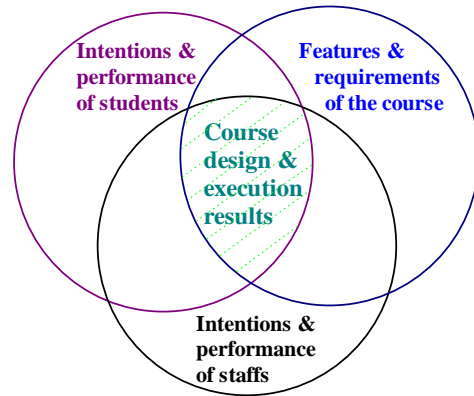

Figure 5. The interaction between students and staffs during course design and plan implementation

3.2.2. Course plan execution and evaluation

To make the student-centred course plan effective in practice, the learning and teaching process is executed in an interactive mode. As shown in the above section, the effect of the performance of both the students and course instructors can be evaluated with the consonance and resonance [11] in the learning and teaching interaction, such as with the beneficial effect to the students in the learning of a specified point. Considering the interaction is directed mainly by goals, and participant's intentions and emotional aspects, which are connected with the value co-creation of the interaction process [10], the viability of the planned value co-creation approach will have a strong influence on the effectiveness of the plan implementation and the results of the learning and teaching activities. A simple way to evaluate a value co-creation plan is to check

its specified goals for each step of the process and the effectiveness of resonance in the plan implementation.

The details of evaluation on the course plan execution results are developed as an evaluating plan [15].

Timely evaluation feedback to students can strengthen learning motivation and the interaction between students and instructors. The evaluation results are effectiveness indicator of the value co-creation and the index of the dynamic process. The results show that as the student-staff partnership frameworks are of course own working context features, a viable value co-creation approach in learning and teaching can make the education process flexible and effective, and beneficial to all of the active participants.

4. CONCLUSION

The improved student satisfaction from the revised course syllabus and its implementation indicates that student-staff partnership and interaction are beneficial to the course design and content development. The experience shows that a viable value co-creation approach in learning and teaching depends strongly on the viability of the specified goals, the enthusiasm of participants, the applicability and timeliness of course information and resources, and the effectiveness of the feedback from the interaction between the participants. The effective student-staff interaction is critical for the flexibility of the course implementation plan, which should have been based on early prioritized information or resources, with specific context and goals.

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