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Competences in Project Management: A Case Study in Osaka Institute of Technology

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Additional information is available at the end of the chapter

Abstract

This chapter briefly explains the distributed project management of four joint departments for first-grade joint project-based learning (PBL). That is, conventional studies and purpose, capital, competence and ability of four kinds of distributed project management were presented, and relations among them are shown after describing background (included prehistory of PBL in Osaka Institute of Technology (O.I.T.)). Then, consideration and analysis about communication, interaction, cooperation, merit, week-point, effect and inference were discussed. Some case studies were described about open innovation and competences in stakeholder management. They were distinctive and superior in first-grade PBL of O.I.T. Finally, some future themes were presented.

Keywords: project management, competence, case study, open innovation, stakeholder

1. Introduction

First, project-based learnings (PBLs) in Japan, prehistory and outline of PBL in Osaka Institute of Technology (O.I.T.), conventional studies and the contents of each section are described in this section. A project is a job having a new element and a certain period (start and end), a work evolving gradually with a clear purpose to be done, influencing the object, and manipulating the object. Competence has various definitions depending on the field but based on the world standard of competence of project manager here, and it makes unique meaning for each distributed project management. Then, it must be used well in the society.

Then, project-based learning (PBL) has been spreading into the world of education because the project-based learning method can develop and improve the competence elements for finding problems, understanding problems and solving problems of the students because the overall thought process for learners in active learning by team-based learning (TBL) is important.

For this, the teachers of four departments including one leader in each class room (The parts of the leaders are project managers who show later in Section 2) should make the structure well-defined about major large problems and student missions by using various competences in the project management.

Here, the project management makes the initial purpose to clear and progress so that it gives skill, technique and tools for achieving the requirements (quality, cost, demand and range of products) of the project. It makes the specifications, plans and methods to clear for require-ments by many stakeholders. Moreover, project management has a SPDCAF cycle, that is, Start, Plan, Do, Check, Action, Finish. Especially, start phase attached to a known PDCA cycle is important because it moves the project from idea phase to plan phase.

The literatures about PBL in Japan were seen in **Table 1**.

The PBL type learning was introduced to Japan as "Engineering Design" by Accreditation Board for Engineering and Technology (ABET). Japan Accreditation Board for Engineering Education (JABEE) advised in 2004 that the Japanese engineering education had only analytic subject and no subject for synthesizing.

Then, JABEE introduced "Engineering Design" as an essential subject to accept by JABEE accreditation. Japanese university with faculty of engineering has introduced "Engineering Design" since that time. This must be further paid attention as a very effective way for active learning. Here, active learning is a study technique by which the students are able to find problems independently, considering the solution for the problems and solving the problems.

In Mechanical Engineering Department of Osaka Institute of Technology (O.I.T.), JABEE had been examined from 2000, and PBL was introduced as a new subject in the third grade (shown in **Table 2**) in 2008 for recognition of JABEE.

After then, the official PBL was spread to second grade and first grade, although the informal PBL was tried in fourth grade of partial laboratory as shown in **Table 2**.

No.	Affiliation	Contents
[1]	Nitobe School	Results of teaching method for the first-grade since 2015 are presented, and findings through this work were shared. In Nitobe School curriculum, there are another education courses (Start-up, Global Issues, Problem-solving and Problem-finding) as four terms (spring, summer, fall and winter).
[2]	Hokkaido University of Japan	Comparison of student attitude by PBL for radiological technologists was introduced.
[3]	Keio University Media Institution	Education for software engineers through university and industry collaboration was done.

Table 1. Example about PBL in Japan.

Course	Term	Prehistory and outline
First-grade PBL	First grade	This started as four departments joint PBL. The Departments of Mechanical Engineering, Electric Engineering, Electronics Engineering and Robotics Engineering jointly conduct the half-year PBL for freshmen. The theme is robot car with multifunction. It started in 2014.
International PBL	Second grade	This is to establish first international PBL between National Taipei University of Technology and O.I.T. It was carried out since 2013 between Electric, Electronics and Mechanical Departments of O.I.T. and Mechanical Department of NTUT. The program is consisted of 1 week of intensive cooperation with five mixed team of students. The theme was robot car and wind turbine with wind lens.
Engineering Practice	Third grade	Mechanical Engineering Department introduced Engineering Practice as an Engineering Design subject. This subject is designed as the 1 year PBL of the design and manufacturing consist of six topics: electric vehicle, hovercraft, engine and motor cycle, robot, steel can recycle machine, and so on.
Graduation Research	Fourth grade	In partial laboratories of Mechanical Engineering Department, few graduate researches had been done like PBL and TBL before/after starting of Engineering Practice as third-year PBL.

Table 2. Outline of PBL in O.I.T.

The outline of PBL in O.I.T. is summarized in **Table 2**.

Nowadays, a project and program management (P2M) model in PBL has become important. Here, the program is a set of several projects assembled and integrated. Then, all the above-mentioned PBL in four grades had better to be managed as a program.

No.	Authors	Contents
[4]	Baumgardner CR, Shane GS, Grant KP	Leadership competences of sustainable construction project management have been explained in literature. The study has generated a new model to facilitate the process of sustainability in the industry and extends some of the significant components from leadership assessment in the context of construction project management in sustainable building projects.
[5]	Amin Akhavan Tabassi, Kamand M. Roufechaei, Mahyuddin Ramli, Abu Hassan Abu Bakar, Radzi Ismail, A. Hamid Kadir Pakir	It has been considered Architecture Management, Economics Evaluation of Project, Profile of Production & Risk Control, Resource Procurement, Competence of Project Management in Project and Program Management (P2M) in Japanese drug development
[6]	Iwasaki K	Technical competence was perceived to be more important for the management of extremely good teams than it was for the management of reasonably good teams.
[7]	Saito T	"Men, money, and material" is usually pointed out in Japan, as capitals of a general project management.
		The literature enlarges to five capitals, added "Information and technique" to these. In addition, they showed five competences of "Foreign adjustment competence, risk control competence, internal control competence, construction management competence, and technical improvement competence."

Table 3. Conventional studies about project management.

This section mainly focused on this joint four department PBL and the distributed project management for the Mechanical Engineering Department out of joint four departments. Here, distributed project management is a new management technique by distributed project managers who consigned partially by the main project manager.

Next, **Table 3** presented conventional studies about project management.

The purpose of this chapter is to present about competences of individual distributed project management as in the case of Mechanical Engineering Department. Moreover, it is to show image of an ideal project management as one and a certain kind of ideal distributed project management taking account of the results.

Section 2 explains competences in distributed project management about relation, competences in each (main, sub, boss, next) project management and evaluation.

Section 3 presents consideration and analysis about "communication, interactions and cooperation," "merit, week point and effect, inference," "an Ideal project management as one" and "ideal distributed project management."

Section 4 explains case study of open innovation by teamwork of enlargement meeting obtained as results of the distributed project management.

Moreover, Section 5 shows competences in stakeholder management including the open innovation, weekly report and joint competition. Finally, Section 6 presents the conclusion.

Especially, Refs. [5, 6] are a drug field, P2M is being handled, and its contents are interesting.

2. Competences in distributed project management

This section presents relation, competences and evaluation about distributed project management.

2.1. Distributed project management

2.1.1. Structure of relation on major project management

First of all, aim and purpose of distributed capital project management group (*Boss, Main, Sub, Next, Stakeholder*) are defined for future integration and redistribution. Although not all project structures always have the same stakeholders (*Boss, Main, Sub, Next*), stakeholder analysis and leadership described in this section are the most usual relationships. We must justify the relation to stakeholders for open innovation.

Aim: Four *Main* are defined for major management of the project by major project managers of four departments. First, the joint meeting was formed by them. *Sub* is defined for support and assist of major project management by sub project manager. *Next* is defined for project management by next generation project managers in the project. *Boss* is defined for project management by boss of the project who proposed the project.
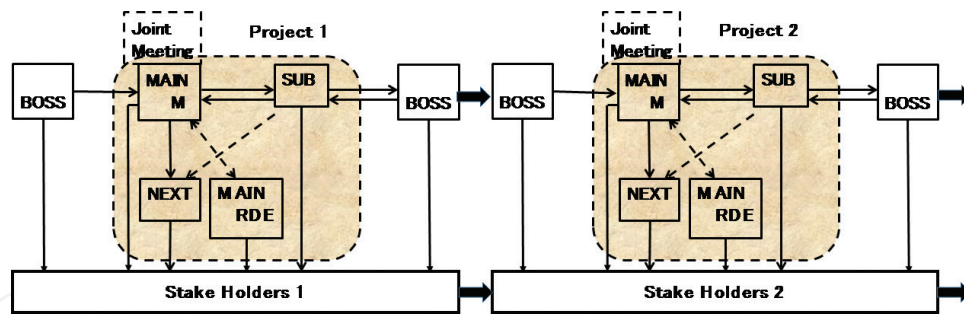
Figure 1. Relation among repeated distributed project management.

Though generally speaking, *boss* of the project or *BOSS* is disappeared from the project after proposing the project, he or it has been appeared again as a general teacher for evaluation and feedback function of the project in this case as shown in **Figure 1**.

Personnel purpose: *Mains* work to lead the project to success cautiously while being afraid of failure, by using power of members in some cases even if it held himself/herself down. *Sub* works to support and assist the main project management and innovates the joint project without fear of failure. *Next* works to learn how the project proposed will be successful. *Boss* works to relearn why the project proposed by him/her was successful.

Figure 1 shows relation among the four kinds of repeated distributed project management (*Boss, Main, Sub, Next, stakeholders i*) by managers (*boss, main, sub, next, stakeholders i*).

Competences (ability to do well) in each distributed project management and relation among repeated distributed project management are explained in the following paragraphs.

2.1.2. Stakeholders management

2.1.2.1. Analysis

For the students in each year, as most important stakeholders changed as every project in this PBL, the individuals of each group decide their roles and group leader through hope by early investigation in the project; then, they have identified their interests by the investigation [8]. Moreover, their interests and influence to the group with students of the other departments can be identified by the teacher's comments in their weekly reports. Original items for the stakeholder analysis are as follows:

- Target of this week (group and individuals).

- Content of execution of the entire group of this week.

- Content of execution of the individuals (inside class time and outside class time).

- Content of discussion in combination meetings.

- Achievement level, reflection point and improvement idea.

- Problem and work schedule for next week.

- Process of the future.

2.1.2.2. Leadership

The definition, purpose and description, and so on of leadership are presented in [8].

Here, the definition of leadership is providing direction and guidance to students and groups. It involves the ability to choose and apply appropriate styles of project management in different situations. Besides displaying leadership with his or her team, the student needs to be seen as a leader in representing the PBL to senior management and other interested parties [8]. Original items for leadership education are indicated in Section 2.6.

2.2. Competences in main project management

Competences in project management for main project managers are at least to seize three pillars of capital "Person, thing and money" and "Personnel right" and "Budget authority", involving the process of executing the responsibility of work allotment to each department. Moreover, they may have competences to present topics in a conference, decide on the schedule, settle the discussion and draw conclusions as chairpersons or sub-chairpersons.

2.3. Competences in subproject management

The project management competences of one subproject manager are based on experience knowledge and through dialogue with other project managers. He understands the purpose and contents of the whole project, proposing the technology necessary for the project competitively with them. He is also preparing explanatory materials for the students until the project gets on track.

2.4. Competences in boss-project management

Competences in project management for boss project manager who conceive the project are personnel ability that can choose talented person who was suitable for content of each project as project manager and are student and teacher's commending abilities, practical work with subproject manager, rich human nature and time management ability.

2.5. Competences in next generation project management

The competences of project management by young next generation project manager can organize the information of the meeting as minutes and can organize the outcome information of the project cleanly without changing its contents and make an external announcement. In consideration to detail, there are also external viewpoints. They were presenting methods of PBL at external meetings [9, 10].

2.6. Competences in stakeholders management

Social basic competences expected in stakeholders of the PBL are taught like the simple followings:

1. Problem solution

The work that fills necessary functions can be made.

2. Team work

They should know members and their ability, and they can help each other.

3. Communication

It puts in two cents hearing others' opinions.

4. Leadership

All members become leaders of something, and their roles are decided for that as the leaders.

5. Creativity

The aspect is changed, and they look at multipronged.

6. Time management

The progress report and the delay measures of the process deciding are managed.

2.7. Evaluation of distributed project management

1. Load reduction of main project manager.

The load of the MAIN increases oppositely, while the load of the SUB has decreased. This might be a result of special circumstances in case of O.I.T.

2. Sufficient number of leaders of classroom.

The member of expansion joint meeting was able to be arranged as at least one leader in each classroom.

3. External sending by various viewpoints.

Three external sending by each different viewpoint have already been done.

4. Effect of feedback by BOSS.

This is not well-understood still.

The next section describes consideration and analysis for the above managements.

3. Consideration and analysis

Moreover, this section adds the following consideration and analysis for the distributed project managements.

3.1. Communication, interactions and cooperation among distributed project management

Interaction, communication, conversation and discussion are not same terms but similar terms [11]. Then, cooperation are noticed as one obtained by human-computer interaction [12]. Here, it is noticed that interactions and communication can draw cooperation.

After observing the proposed method of distributed project manager compared with an ordinary project manager, communication, interaction and cooperation, which are selected as most important matters, were shown in **Table 4**.

3.2. Merit, week point and effect, inference analysis of distributed or decentralized project management method

Effect, inference and yield in failure mode or action mode, and so on were used for analysis of various systems in conventional study [13].

Here, **Table 5** shows merit, week point, effect and inference of proposed method of distributed project management compared with an ordinary project management briefly, although they were old and ordinary methods.

3.3. An ideal project management as one

The following item and six contents, which were integrated as ideal management of one and will cause a lot of main management of project, can be obtained after seeing the project management in which capital, rights and competences were distributed.

Table 6 shows a certain kind of ideal project management as one.

This will be important as a consensus problem in multiagent optimization systems in the future, although these contents do not obtain the consensus [14].

3.4. An ideal distributed project managements

Achieving an ideal abovementioned project management alone is difficult, the example of trying ideal four distributed project management is shown in **Table 7**.

This may be approaching to an optimal distributed project management, although this is not different from real distributed management.

Item	Contents
Interactions	There are both positive and negative interactions among the distributed project managers.
Communication	The chance of conversation between PMR increases, although there is also miss-over order [13] from *Main* or *Sub* to others in their communications.
Cooperation	They can draw cooperation by sharing the same target consideration.

Table 4. Interactions and communication can draw cooperation.

Item	Contents
Merit	There is a possibility that they can do something, which one project management is unable to do. They can reduce the load of main project managers.
Week point	Human cost up. However, it may not be a problem in the special environment like organizations for education.
Effect	*Next* grows up and the evaluation rises.
	All distributed project managers are able to know the project.
Inference	Spread of upper-grade PBL or another PBL after long time.

Table 5. Merit, week point, effect and inference.

Item	Contents
Five capitals	"Persons, objects, time, space and money"
Five rights	"Personnel right, budget authority, scheduling right, space securing right and greeting"
Five abilities	"Innovation of technology, control of information, information sending to inside and outside after taking and settling, agency to various distributed managers, to honor"
Five natures	"Cooperative, competitive, charismatic, responsibility and sympathy"
Five senses	"Selecting themes, material, parts, terms and methods"

Table 6. A certain kind of ideal project management as one.

Item	Boss	Main	Sub	Next/part
Capitals		"Persons, objects and money."	"Time, space" "Information, technology"	
Rights		"Personnel right, budget authority and greeting"	"Scheduling right and space securing right"	
Abilities	"To honor and information sending to outside"	"Control of information, information sending to inside and *"	"Innovation of technology, control of information, information sending to inside and outside after taking and settling, agency to various distributed managers"	"Control of information, information sending to inside and outside after taking and settling"
Natures	"Cooperative, charismatic, sympathy"	"Cooperative, competitive, sense of responsibility, sympathy"	"Cooperative, competitive, sympathy"	"Cooperative, sympathy"

Table 7. A certain kind of ideal four distributed project management.

It seems that repeating while deliberating integration and decentralization like this is useful for the optimization of the system that does not use the expression.

This may be necessary in the future theme as a distributed optimization problem [14].

In the next section, we will explain the open innovation by team works of project managers, including openly distributed departmental and interdepartmental project management.

4. Open innovation by teamwork

This section presents open innovation by teamwork of project managers and stakeholders.

Open innovation is done in teamwork, while closed innovation is done individually.

4.1. Case studies

In multicultural engineering [15], a few open innovations [16] were tried by teamwork in project management. Some case studies are described in the following paragraphs.

4.1.1. Case 1

4.1.1.1. Procedures

1. Awareness of scenario valued for Mechanical Engineering Department team in joint four department of PBL from a symbolic object by subproject management. (Affordance of the object: Slope course like hill excess as shown in **Figure 2**).

2. Proposal of innovation by subproject management.

3. Support of innovation by main project management and stakeholder management (especially for TA).

Examples of products: a mechanical sensor, controller and actuator on a car for throwing a ping pong gem from the box out of the goal wall without electric power source (**Figure 3**).
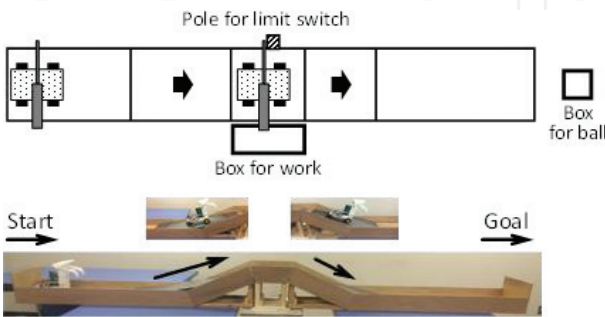

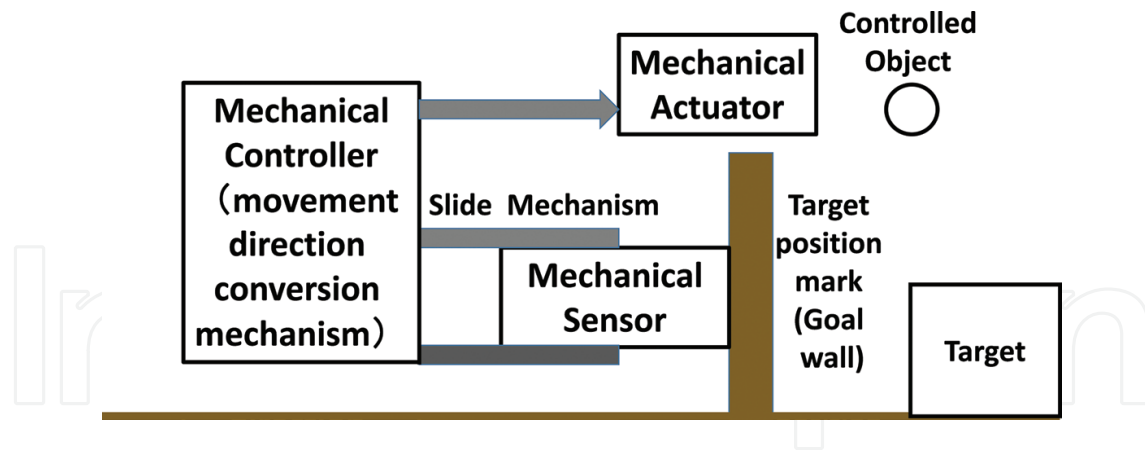**Figure 2.** Courses with slope like hill where model cars run.

Figure 3. Configuration of mechanical position ON-OFF control with position detecting SW.

4.1.2. Case 2

4.1.2.1. Procedures

1. Motivation of innovation considered load balance by enlarged project management

2. Challenge and change of innovation by subproject management

3. Awareness of culture and value of innovation by main project management (message between the project managers in joint meetings)

4. Support of innovation by main project management and stakeholder management (especially for specialists and experts)

Examples of products: a set of noncontact feeding coils to transmit and receive the high-frequency power for detecting the goal wall (**Figure 4**).

In the next section, competences in stakeholder management are presented including open innovation.
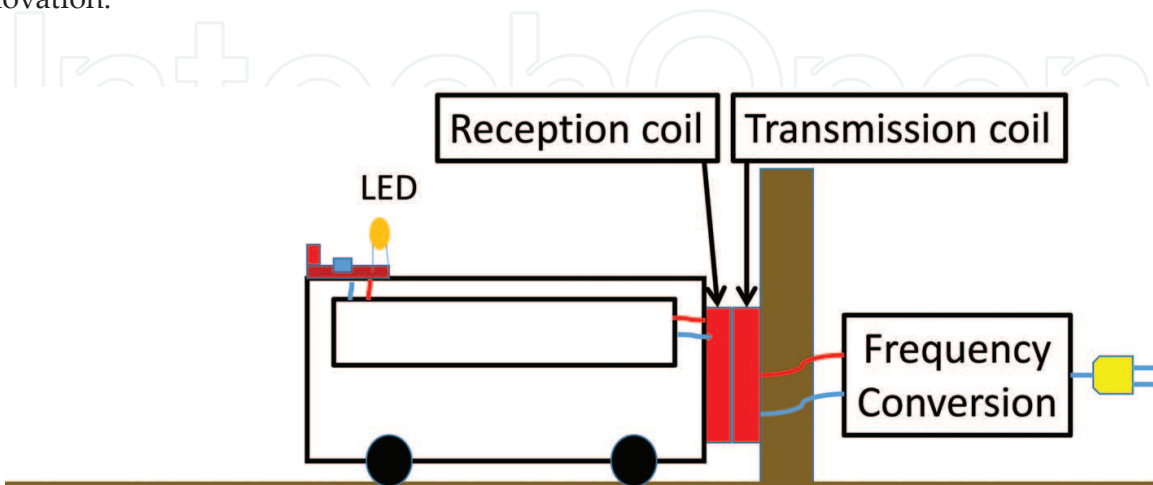

Figure 4. Noncontact feeding twin coil.

5. Competences in stakeholder management

This section presents competences in stakeholder management for open innovation, weekly report and joint competition.

5.1. Competences in stakeholder management for open innovation

In Case 1, TAs instructed by a main project management were active as stakeholders.

In case 2, teachers asked by a main project management who did not participated in the project as stakeholders who supported the project management. To summarize, it was recognized that not only teamwork but also stakeholder management including the section manager plays an important role in the success or failure of the project.

5.2. Competences in stakeholder management for weekly report

The weekly report was imposed on the administrators to properly modify the form in each department. By letting students write a report in this form, they can grasp the common problems of all divisions and individual problems of each division and draw out the direction of student behavior for problem solving. Competences for making format of weekly report may be knowledge to teach the PBL and experience for incompleteness of the first-grade students' description matter for past weekly reports.

5.3. Competences in stakeholder management for joint competition

There are two cases of innovative technology by a main project management. In both cases, technical competencies for providing web address to upload word file or excel file, information management for settling important rules and scores of competitions are needed.

5.3.1. Case 1: explanation function of joint competition in orientation

The following specification of action flow chart expression (**Figure 5**) was most innovative and easy to understand for stakeholders including mechanical department.

Grey boxes mean the charge of mechanical department. Competences for making a chart like this chart may be knowledge on sequential flow chart using sequence control.

5.3.2. Case 2: online monitoring of joint mission and recent rules for joint competition

Because the rules for competition were changed by circumstances, they are managed by main project management so that wireless LAN of PC of each classroom may monitor the mission and the rules online though the joint mission and the rule for joint competition were explained in the orientation at first. Competences for making a system like this system may be knowledge about information and communication in PC. An example is shown in **Figure 6**.

5.3.3. Case 3: online monitoring of score book in joint competition

Because the scores of each team of other class rooms in competition were not known, they were managed by main project management so that teachers can change and monitor the
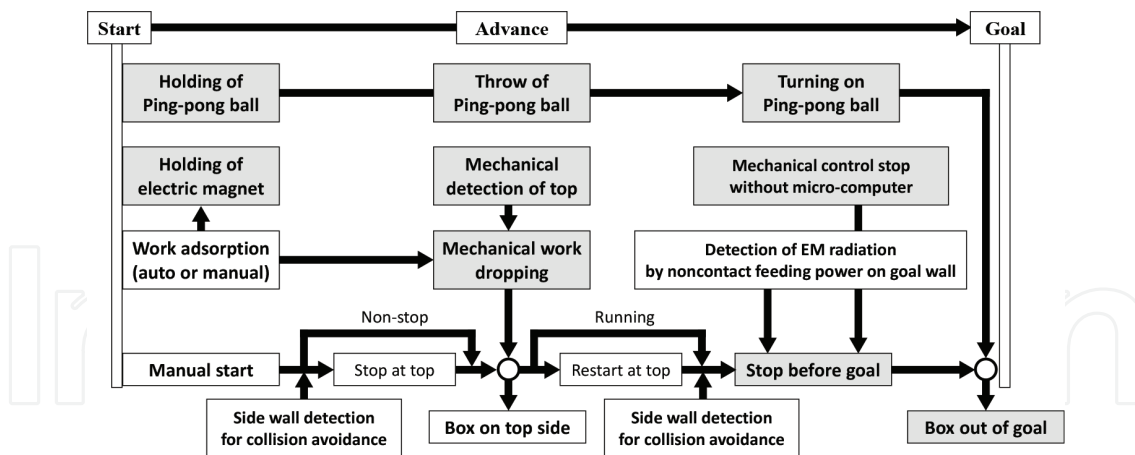
Figure 5. Action flow chart as explanation function of joint competition.
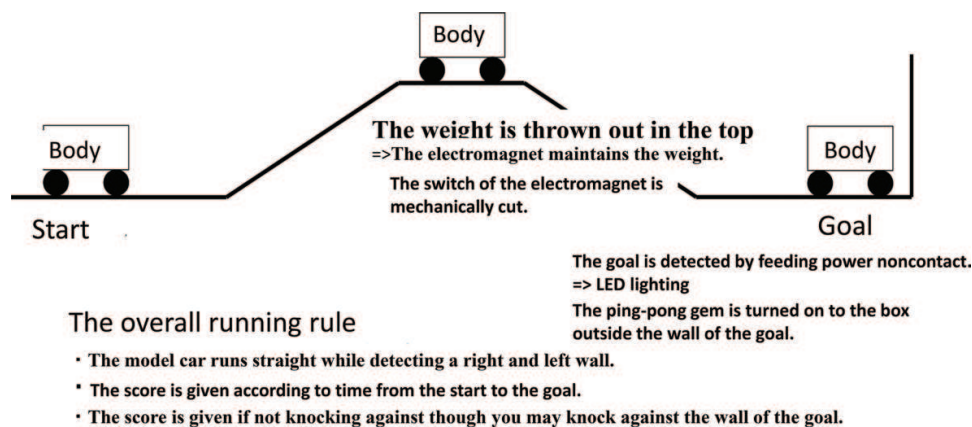

Figure 6. An example of online monitoring of joint mission and recent rules for joint competition.

scores, and other stakeholders will be able to monitor them through wireless LAN of PC in each classroom. Competences for making a system like this system may also be the same as the above system. Specification of online score book is shown in **Table 8** for reference.

Class room	Group and try no		Running time (s)		Work enter in the box	Ping pong gem enter	Penalty at wall		Bonus at goal		Total score
			to top	to goal			Collision to wall	Stop car	Light LED	Stop wheel	
151	1 Group	1									
		2									
	2 Group	1									
		2									

Table 8. Specification of online score book.

6. Conclusion

The distributed project management method for the first-year PBL of joint departments was proposed and considered about some important items after presented each distributed management and shown relations among the distributed managements.

The motivation leading up to this topic is the discovery of the book [14]. The problem of integrating distributed management would be a consensus problem, and there was a speculation that the method of distributed optimization could be used when decentralizing the integrated management.

A large advantage of such a distributed and decentralized project management method mutually supplements various project managements, goes up the perfection, executes a role each other and decreases the load concerning the project if it is compared with a conventional project management method.

It is important that such a new attempt concerning the project management of the Mechanical Engineering Department is the one approved by the management of another department. (It is because those advantages are shared.) Such an attempt does not succeed without fail, and it greatly depends on the competences of the member who participates in the same meeting. Therefore, it does not necessarily succeed even if the same thing is done by another project.

Some case studies were described about open innovation. It was motivated by which the hill excess course of model car makes to associate the blackout measures for accident of nuclear power generation caused by tsunami.

Then, competences in stakeholder management were discussed. They were distinctive and superior in first-grade PBL of O.I.T.

There are some future themes when you examine such context closely as follows:

1. It is necessary to clarify the competences by thinking about the ability of each distributed project management for clarification of conditions for the application of such distributed project management to other projects.

2. Problems derived from optimal controllers of projects ranging from ideal optimized project management to distributed project management [14].

3. Optimal consensus problem for an ideal optimized project management by distributed project management [14].

4. More appropriate lecture about project management may be necessary for first-grade students [17, 18].

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