

## "Research Paper"

### **Three-Dimensional Evaluation of Technical Cooperative Education Programs for a Challenging Higher Education**

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#### **Abstract**

We developed "*Technical co-op practice ( technical work integrated learning )*" at Ritsumeikan University (RU) in 2008. In this practicum, teams made up of a mix of postgraduates and undergraduates in the college of science and engineering were given projects developed by two companies. The teams have to solve some technical problem in six month. The practicum is designed to enable the postgraduates to take up leadership roles in project management and contribute to their area of specialization.

Taxonomy is widely used to identify an educational target. Taxonomy can be viewed in three areas "cognitive domain ", "affective domain ", and "psychomotor domain ".

We conducted a *three-dimensional evaluation* process of postgraduates and undergraduates who had completed the entire co-op practice course as follow:

- (1) Self- evaluation by students.
- (2) Mutual evaluation in student teams.
- (3) Objective evaluation by an academic advisor.

We drew up twelve common evaluation indicators that apply to all the *three-dimensional evaluation* processes. These twelve indicators are categorized in the application of academic knowledge, the team activities, the ability to discover and solve issues and their values.

As a clue to analyze the active status of team activities, we added a leadership category that consists of team operation, team management, and attention to member indicators. We then used these fifteen evaluation indicators for this study.

Interesting observations were made on the difference of the evaluation patterns between the students and their leader. The “*active cycle team*” showed the highest scores in the leadership category. On the contrary the “*non-active cycle team*” did not observe similar kinds of leadership scores.

**Key Words:** *Technical co-op practice, technical work integrated learning, three-dimensional evaluation, active cycle team, non-active cycle team.*

## **Introduction**

It was not until the early 1990s that Japan introduced cooperative education, nearly 90 years after the introduction of world’s first cooperative education programs at the University of Cincinnati in 1906.

According to Herman Schneider, “Cooperative education” is defined essentially as the “joining of theory and practice.” Based on this definition, the educational content should be closely connected to each student’s field of study and the period of work practice should be relatively long. Both universities and the industrial world must make great efforts to develop and manage the program. Therefore in Japan, short-term internship programs which were easy to introduce have spread quickly, and internship is often explained by the media as “employment experience.” Thus, the common emphasis of the internship on “education” has been switched to “training.”

In Japan, many of the internships last only a few days, or ten at the most, and are often not for credit with regards to students’ academic studies. Recently, many one-day internships and half-day internships have also appeared in Japan. (Fig.1)

These internships have brought about several problems. First, the quality of participating students has declined. In the late 1990s, many universities introduced cooperative education programs without fully understanding the philosophy of the concept. Students were often sent off to companies without receiving sufficient training from the university beforehand, this led to many problems for the receiving companies and increased the burden placed on these companies. Because of problems like these, many major Japanese companies, such as Sony, have stopped offering internships altogether.

Another major problem that companies often merge internships with their recruiting

practices. Most students in Japan participate in internships during the summer vacation during the third-year of their four-year university experience. Some companies have taken advantage of this timing to use internships as a means of securing outstanding future employees; thus using the internship mainly as a recruiting program (one-day and half-day internships are the typical examples). Because these students, who still have one year of university ahead of them, are forced to begin their job search activities during the summer of their third year, consequently their studies during their last year suffer immeasurably.

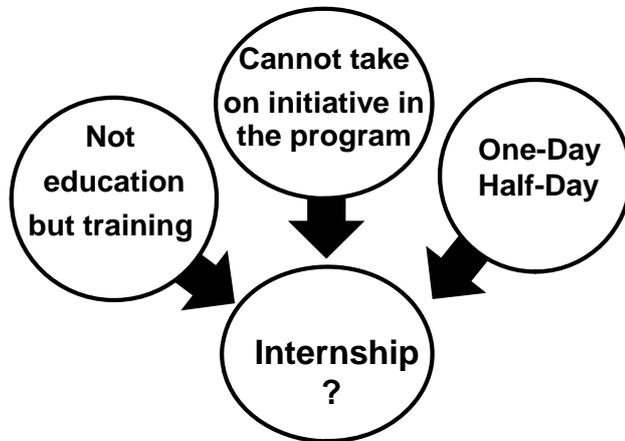
The final problem is company exploitation and diversion of internships as a form of cheap labor. Although limited to a handful of companies, there have been cases where a company makes use of the unpaid nature of internships and employs student interns as a source of cheap (or at times, totally free) labor for work previously done by part-time employees.

Recently, the limitations and problems associated with internships have become widely recognized, and there has been a gradual movement towards returning to the original goals of cooperative education in Japan. In light of this the Ministry of Education established the “Program to Support Efforts to Meet Contemporary Educational Needs” program in 2004, and included Collaborative Educational Programs between Universities and Corporations as one area of support. The target of the Ministry of Education’s support is not internships, but rather cooperative education. Financial support comes from the country, and pays about ten million yen per year to excellent programs.

In 2005, university-level cooperative education efforts were given a boost by the establishment of the Japanese Ministry of Education’s “Cooperative Education Plan for Off-Campus Advanced Personnel Training.” Although this plan mainly offers support to programs designed for graduate students, the Ministry of Education ranked RU’s Practicum in Work-Integrated Learning fifth among the programs of 55 universities in Japan and has awarded RU a grant totaling 33 million yen to cover project costs for a period of five years, from 2005 to 2009.

In so doing, the Ministry of Education’s new program has spurred renewed interest in true cooperative education programs that last for periods of one month or more under the national strategy through undergraduate faculties and graduate schools.

**Fig.1 Expanding of internship and expectation of cooperative education in Japan**



## **I. Cooperative Education Philosophy and Policy at RU**

We have launched a research and development for Japanese-style cooperative education programs based on the information gathered at WACE with the goal of improving the quality of the programs at RU. Cooperative education at RU is grounded in the Ritsumeikan University Cooperative Education Philosophy and Policy, established in March 2003. The fundamental points of the internship philosophy are as follows:

- (1) The university's cooperative education programs should be part of an academic curriculum that promotes student growth, development, and learning.
- (2) Through gaining work experience in economic society (broadly defined as industry, government, school, and community), cooperative education programs should provide students with an awareness of the societal value of their education as well as the social demands placed on their education.
- (3) Cooperative education should equip students with the practical skills necessary to resolve issues and problems in the workplace, thus developing their sense of social responsibility and enabling them to become more capable individuals by strengthening self-reliance and motivation to improve.

In essence, RU's cooperative education programs should be classified as "educational programs that reaffirm both the enjoyment and significance of university education."

We want all cooperative education program students, even students participating in short-term work experience, to have a strong awareness of the relationship between their work practice and their field of specialization. In addition to that we also want them to have a firm understanding of both the enjoyment and significance of their university education. Finally, after students have completed their cooperative education experience, we want them to return to the university and continue their studies still more invigorating. All RU faculty and staff involved in cooperative education programs work daily with this philosophy in mind.

## **II. Features to the Practicum in "Co-op practice" at RU**

We have developed "co-op practice ( work integrated learning ) "since 2005. The practicum is designed as a learning program in which mixed teams of both graduate and undergraduate students put their specialized knowledge into practice by working together with a company to solve an actual problem in six month. Each business challenge is decided upon through discussions between Ritsumeikan University and the partner company, with the goal of developing a real-life situation that relates to the specializations of the team members.

In order to limit the burden placed on the recipient companies, students are required to attend a two-day pre-internship workshop and a one-day post internship workshop and they are also expected to submit various reports.

Physically the students do not actually go to the company. Students only contact the company on a need to basis. As a result any additional kind of work on the part of the company is significantly reduced. The practicum enables the graduates to take a leadership role in project management and at the same time contributes to their area of specialization.

There are four main features to the practicum in "co-op practice"

### *1 ) Internship based on Work Integrated Learning.*

Internships should equip students with the practical skills necessary to resolve issues and problems in the workplace, with the aim of developing their sense of social responsibility and enabling them to become more capable individuals by strengthening

their self-reliance and motivation towards improvement. In contrast with internships that place emphasis on experience, the purpose of the practicum is to (a) validate students' area of study and to improve their practical skills, and (b) to improve their self-directed studying skills and motivation for learning.

## *2 ) Project-Based Learning through with Mixed Teams of both Graduate and Undergraduate Students.*

In order to achieve the above mentioned purpose, each team consists of one graduate and four undergraduate students who are drawn from different faculties.

The graduate student (a) examines the project from the perspective of their area of specialization and (b) guides and instructs the undergraduates, and in so doing, broadens their own leadership skills.

The undergraduates are expected to interact with their fellow project members and learn other methods and approaches from different faculties and improve their social skill through discussion with undergraduates from other fields of study.

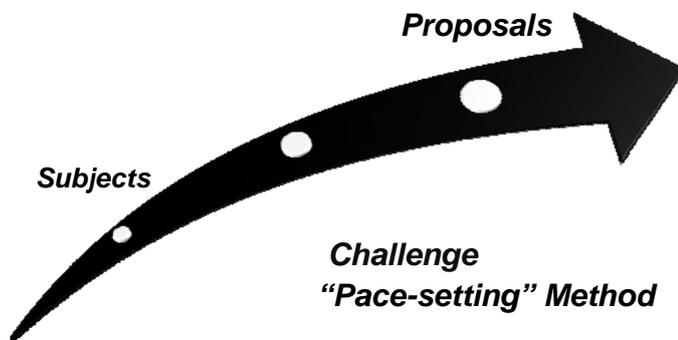
## *3) The Teacher's Role as a Pacemaker.*

In this practicum of work-integrated learning, we offers weekly on-campus workshops for each team, however there is minimal faculty input at these meetings. This is deliberately done so as to encourage the students to develop their own motivation for learning.

Project based learning (PBL) is a method based on problem identification and solution solving, this practicum can be considered to be an exercise in PBL. However, most of the times these programs are actually regular curricula course in which an instructor from the faculty provides full support in solving a specific problem that concerns a specialized field of study. Thus, strictly speaking, these programs are not really internships because it involves little of autonomous study activities and work.

We have developed the "Pace-setting" method as a result of trial and error. An analogy can be used to demonstrate the role of the pace maker in the practicum if we consider the students as marathon runners and the faculty members as the "pace maker" runners that set the pace for the athletes. Although pace makers run and sweat with the runners, they do not directly help (teach) the runners. (Fig.2)

**Fig.2 The process of the Practicum  
Co-op practice at RU**



Regulated instruction carried out by teachers can inhibit creative ideas and independent thinking. As opposed to the framed and taught ideas that students learn in a classroom environment, students in this practicum can learn true innovative thinking applicable to the real world environment. Therefore the teachers are compelled to allow students discover solutions on their own.

#### *4) Assessment of Educational Effects of Cooperative Education Programs.*

It is crucial for us to evaluate educational effects of "co-op practice programs". (Fig.3)

The university's internship programs should be part of an academic curriculum that promotes students growth, development, and learning. Through their work experience, internship programs should familiarize students with an awareness of the societal value of their education as well as the social demands placed on their education.

The university evaluation criterion requires students to be from a specified discipline in their university. Taxonomy is widely used to identify an educational target.

Taxonomy is divided into three areas "cognitive domain ", "affective domain ", and "psychomotor domain ".

### **III. "Co-op practice" in 2008**

For the co-op practice in 2008, nine teams were formed at the Kinugasa Campus in Kyoto city and eleven at the Biwako Kusatsu Campus (BKC) in Kusatsu city, located in southern Shiga. Eight prominent companies in Kyoto, Shiga, and Kobe, *namely*, Kyocera, the Hotel Nikko Princess Kyoto, Kyoto Shimbun, Kyoto Chuo Credit Association, Shiga Bank, ISHIDA, NEC-SCHOTT Components and Kobe Shimbun participated in Co-op practice. This brings the total number of companies to eight and

the number of teams to twenty.

During the course of participating in cooperative education programs, there are times when a student's work practice involves dealing with private information. In April 2005, the Government of Japan enacted legislation protecting the privacy and use of private information, placing severe restrictions and conditions on the management of private data. Consequently, students must participate in a basic training session that highlights the protection of privacy, confidentiality of the receiving company, etc., these sessions are conducted by a specialist from RU's School of Law.

The student participants are chosen and a risk management training workshop is held for the participants in July. The main actual program begins in full force in September when the students attend an overall training seminar held at RU and then spend two days participating in various activities at their respective companies.

In October, a training workshop in project planning is held and the students begin to work on designing solutions for the proposed problems. During this time, the students attend regular classes throughout the day and meet to discuss the co-op project one evening a week.

In mid-November the students attend a training workshop on presentation skills and then present a mid-term report to the companies. Most of the time in December is used for doing the final research and developing presentations of the results are held from the end of December to the beginning of January. Finally, the students have until March to write individual reports.

In cooperative education programs, it is crucial for us to evaluate results of the programs. The university evaluation criterion requires students to be from a specified discipline in their university. Taxonomy is widely used to specify an educational target. Taxonomy is divided into three areas "cognitive domain ", "affective domain ", and "psychomotor domain ".

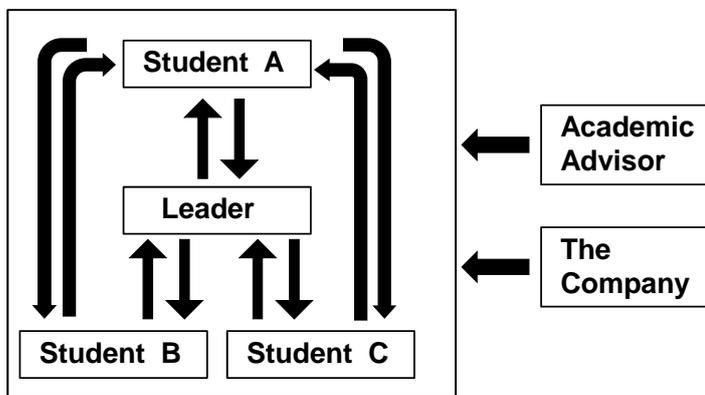
In January 2009, we conducted three-dimensional evaluation processes of one hundred students who had completed the entire co-op practice course: (1) self-review evaluation by students, (2) mutual evaluation in student teams, and (3) objective evaluation by an academic advisor. (Fig.4, Fig.5, Fig.6)

We set twelve evaluation indicators that apply to all the three evaluation processes: enhancement of basic academic performance (evaluation indicator 1, only numbers will be shown), acquisition of knowledge (2), application of academic knowledge (3), contribution to results (4), involvement in team activities (5), collection and practical use of information (6), understanding challenges (7), discovery of issues (8), solving issues (9), developing observation skills (10), broadening perspective (11), and

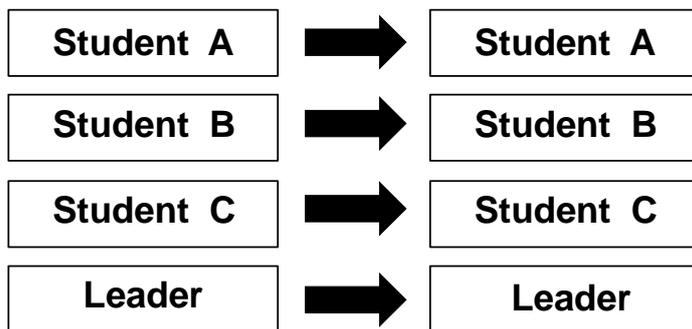
achieving self-sufficiency (12). Among these 12 indicators, (1) through (3) are categorized in the application of academic knowledge, (4) to (6) in the team activities, (7) to (9) in the ability to discover and solve issues, and (10) to (12) in values. In the concept of the taxonomy of educational objectives, (1) through (9) belong to the cognitive and psychomotor domains and (10) to (12) belong to the affective domain.

As a clue to analyze the active status of team activities, we added the leadership category that consists of three evaluation indicators: team operation (13), team management (14), and attention to members (15). We used these fifteen evaluation indicators for this study.

**Fig.3 Evaluation System in Co-op Practice**

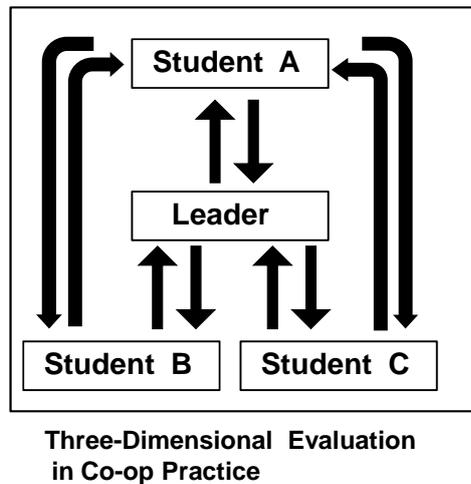


**Fig.4 Self-review Evaluation by Student teams**

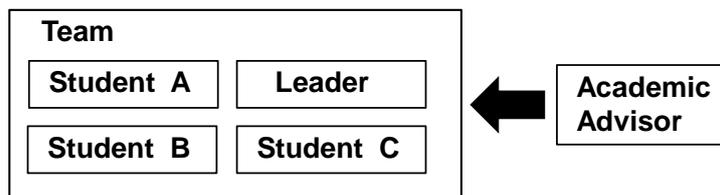


**Three-Dimensional Evaluation in Co-op Practice**

**Fig.5 Mutual Evaluation in Student teams**



**Fig.6 Objective Evaluation by an Academic Advisor ( Professor )**



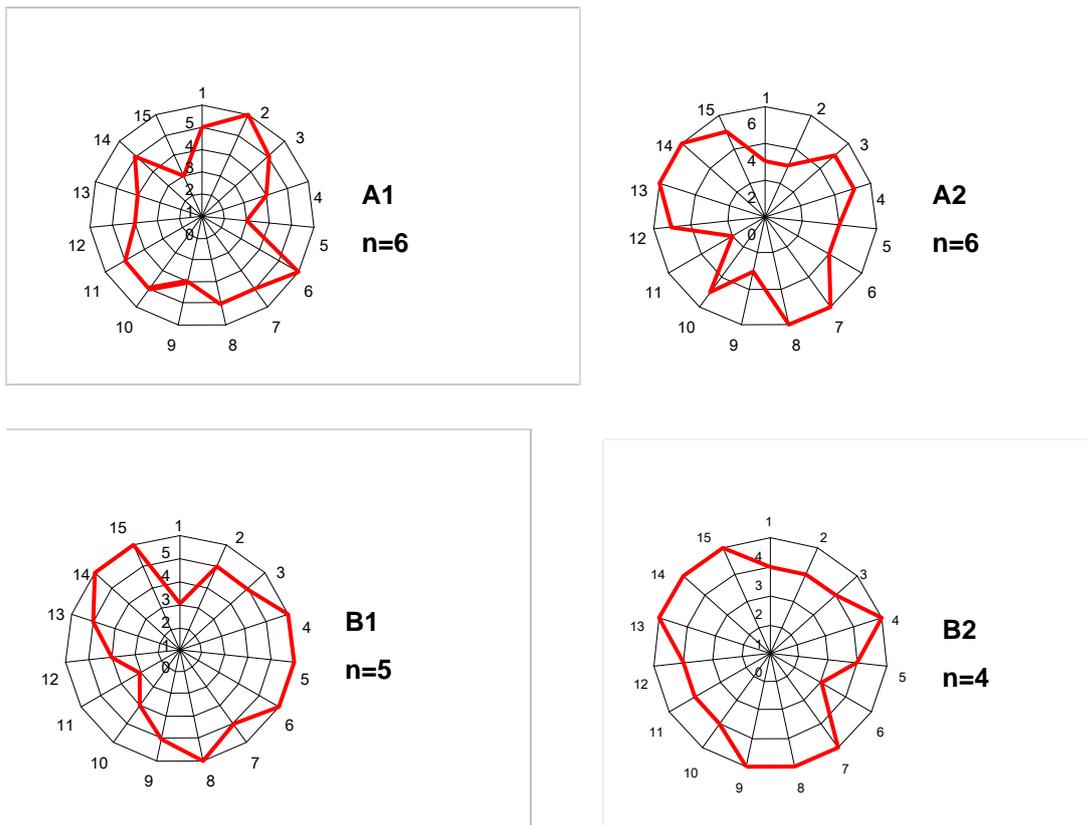
#### **IV. Technical Co-op Practice Involved in Active or Non-Active Cycle Team.**

We also developed "*Technical co-op practice ( technical work integrated learning )*" in 2008. In this program, teams made up of a mix of both graduates and undergraduates in the college of science and engineering were given technical projects developed by two companies (ISHIDA and NEC-SCHOTT Components). The practicum was designed as a learning program for both graduate and undergraduate students to put their specialized knowledge into practice by working together with researchers of the partner company to solve an actual technical problem in six month.

In this study, we also conducted a three-dimensional evaluation process of students

who had completed the entire cooperative education practice course for half a year: self-evaluation by students, mutual evaluation in student teams, and objective evaluation by an academic advisor and used fifteen evaluation indicators in order to discuss three-dimensional evaluation process of technical cooperative education programs for higher education.

Among the teams, four of them at BKC (ISHIDA and NEC-SCHOTT Components hereunder referred to as A1, A2, B1 and B2) had leaders that were first year master's students in science and engineering. These two leaders belong to the same laboratory. They are engineer students with outstanding academic performance, and are honest and diligent in nature. The teams also had shared common traits in terms of undergraduate members. Four teams consisted of students from the science faculty composed of both scholastic and active students. However, there was contrast exhibited in the learning activities of one team and three teams of the remainder.



**Fig.7 Evaluation of the Leader by the Undergraduates  
(The mean value and the number of students)**

Team A1 was disorganized throughout the course of the technical co-op practice, and the learning activities were interrupted for a short time. On the other hand, we could

see sound teamwork and conformity in Teams of A2, B1 and B2 from the beginning. Contrary to Team A1, Teams of the remainder (A1, B2 and B3) were vigorously involved in learning activities throughout the course, and the company staff that it cooperated with evaluated the team highly for its presentation of the result report.

Regarding the reasons why those four teams took such contrasting processes in spite of the common features drew interesting results taken from the reciprocal evaluation of leaders in the teams. The analysis below is given considering Team A1 as a team with a non-active cycle and Teams of A1, B2 and B3 as that with an active cycle.

Figure 7 compares the evaluation of leaders by members (undergraduate students) between Teams of A1, A2, B1 and B2.

The active cycle teams are characterized by the form that expands towards the upper left and the lower right. The non-active cycle team shows a shape that shrinks towards the center and slightly expands to the upper right. We examined the figure based on the evaluation indicators. The active cycle teams demonstrates the highest scores in the three evaluation indicators related to leadership (13 to 15) while the understanding challenges, indicator(7) and discovery of issues, indicator (8) are also highly evaluate.

## **V. Conclusion**

The Practicum in Work-Integrated Learning, part of Ritsumeikan University's "Technical Co-op Practice" was introduced in 2008. The practicum is designed as a learning program in which mixed teams of both graduate and undergraduate students put their specialized knowledge into practice by working together with a company to solve an actual technical problem. Each business challenge is decided upon through discussions between Ritsumeikan University and the partner company, with the goal of finding a real-life problem that relates to the specializations of the team members.

In this study, we discuss three-dimensional evaluation of technical cooperative education programs for higher education.

In total, we can say that the kinds of behavior that the leader provided to support the active cycle teams, based on members' evaluation, are (1) to promote understanding on issues at the beginning stage of the team, (2) to provide leadership during the course of the technical co-op practice, and (3) to drive team activities in a broad sense such as acquiring knowledge and collecting information. On the other hand, the non-active cycle team members considered that they did not see the kinds of leadership behavior seen with the active cycle team leaders, they also suggested that it was only their leaders

who ended up developing their own capability (acquisition of knowledge).

These results indicated that a certain degree of support by an academic advisor was required so that the operation of teams became smooth and so that leaders could gain the trust of members at an early stage. It was also realized that motivating members was an essential factor in team operation.

Future challenges would entail further improvement and development of the method and effective measurement/evaluation of the technical co-op education, which would also lead to the clarification of the role of the internship in society.

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