

Influence of a Co-op Program on Participants' Academic Performance, Employment and Job Performance: Focusing on the Case of KOREATECH

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[Abstract]

KOREATECH has operated a Co-op program called 'Industry Professional Practice (IPP)' that allows students to work full-time in relevant industries for at least four months since 2012, and also developed a systematic performance evaluation model on the basis of Kirkpatrick's four-stage assessment model. This study aims to share KOREATECH's Levels 3 and 4 evaluation results which are clearly what practitioners and academic investigators of cooperative education want to know the most. For this purpose, a questionnaire survey was conducted for KOREATECH graduates and their superiors to examine influence of IPP experiences on employment and job performance. A total of 730 alumni who graduated within last 5 years participated in the survey, with 213 (29.2%) having IPP experiences, and 162 superiors rated their subordinates on seven performance criteria. The analysis results were mixed. On the one hand, employment rate of IPP participants was 89.7%, compared to 86.8% of alumni without field experiences. Participants of the IPP program were more satisfied with their salary and felt less unfair about their career and promotion opportunities than alumni without field experiences. On the other, superiors rated their subordinates without IPP experiences slightly more positively than IPP participants in terms of job performance. These contrasting results are judged to show strengths and weaknesses of the IPP program at the same time. The limitations of the study and future research directions are discussed at the last part.

Key Words: Co-op, Employment, Job Performance, Questionnaire Survey, Graduates

1. Introduction

KOREATECH has designed a long-term co-op program called IPP (Industry Professional Practice) that allows students to work full-time in relevant industries for at least four months since 2012. In order to address problems in engineering education of Korea and compensate for the problems encountered by traditional short-term internship programs, KOREATECH benchmarked the cooperative model developed

in North America, and adapted it for the Korean educational system.

In addition, KOREATECH has developed a systematic performance assessment model to evaluate the effectiveness of its IPP program and find ways to improve the program's operations and procedures on the basis of the Kirkpatrick's four stage performance evaluation model for training programs. For this purpose, thorough review on the training program evaluation literature and in-depth analyses of overseas cases

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of co-op performance evaluation were conducted, and a set of IPP performance evaluation criteria were developed. Now, these evaluation criteria are applied to the KOREATECH's IPP operations every year. Two student questionnaire surveys are administered before and after IPP terms to measure students' reactions to the IPP program (Level 1) and changes in participating students' attitudes and competencies (Level 2) every semester. In addition, the effect of IPP experiences on graduates' academic performance, employment, and job performance is also analyzed at work (Level 3 and 4) every three years.

This study aims to share KOREATECH's Level 3 and 4 evaluation results which are clearly what practitioners and academic investigators of cooperative education want to know the most.

II. Literature Review

Parsons et al. [1] examined the role of individual differences and early employment experiences on learning outcomes and subjective well-being for first-term cooperative education students. They found that there were some early warning signs of lack of adjustment that were related to both motivational anxiety and lack of initial social contacts during socialization, and mid-semester reports of proactive behavior by the student had a significant impact on both learning outcomes and well-being.

Schuurman et al. [2] examined how undergraduate work experiences affected engineering graduates' post-graduation starting salary, their cumulative grade point average upon graduation, and their likelihood of receiving a job offer prior to graduation. They found that more experience resulted in a higher post-graduation starting salary and an increased likelihood of a job offer prior to graduation. But increases in cumulative GPA upon graduation were only marginal. Furthermore, undergraduate work experience affected female and male students as well as students from different majors similarly.

Blair et al. [3] examined the effects of cooperative education on grade point average, length of time in school, and starting salary. They found that cooperative education programs had significant effects on all three dimensions. That is, engineering

students who completed the three-semester cooperative education program earned higher GPAs than non-coop students, earned more in terms of starting salaries, but took approximately two semesters longer (7 months) to complete their undergraduate program.

Rezin [4] compared the industry success of graduates from both traditional campus-based programs and cooperative apprenticeship programs three years after graduation. The results showed that cooperative apprenticeship program participants had higher related employment rates, annual income, career advancement, and satisfaction with industry preparedness than graduates of traditional campus-based programs.

Tanaka [5] analyzed statistically the effectiveness of career-oriented education (cooperative education) on the alumni's employment performance. The statistical analysis included alumni's attributes such as gender, faculty, GPA's, as well as career-oriented course attendance, and their thoughts on earlier student life, present employment, the relevance of soft skills they acquired at university to the present employment, and work attitude. He found that career-oriented courses and Work-integrated Learning seemed to help students prepare well for their working life through having more realistic view about working. He concluded that career-oriented education and WIL are effective tools for smooth transition from study to work by helping students build an objective understanding about working life.

On the basis of these previous research, the effectiveness of KOREATECH IPP program is examined in this paper in terms of its influence on recent graduates' academic performance (GPA and duration of time in school), employment (employment rate, job choice criteria, coupling of major and present job, and post-graduation starting salary), and job performance (job satisfaction, organizational commitment, and performance evaluation by graduates' direct superiors).

III. KOREATECH's Co-op Program: IPP

Since its inception in 1991, KOREATECH has designed and operated a KOREATECH educational model in engineering that reflects industry demand and has the clear educational objective of training skilled engineers and technicians. The main features

of this model include: fostering human resource development (HRD) capabilities; maintaining the 50:50 ratio between theory and practice (conducting experiments); producing capstone design products linked to industrial needs; recruiting full-time university staff with significant field experience; and having its staff operate a field research semester system. From 1991, KOREATECH has fostered field education by offering "internship" as an elective major course, and maintained it as a required major course for all students since 1997. In 2011, KOREATECH researched ways to introduce an industry professional practice (IPP) system, as well as operational models of the system; it invited international experts from world-class universities to an international conference, establishing an IPP center dedicated to IPP operations (Oh et al., 2011). After the successful completion of a pilot program that ran from August to December 2012, the school has pursued full-fledged IPP program since March 2013. At present, the IPP program is operated as an elective course; upon completion, students are exempt from short-term internship, which would otherwise be a required course.

KOREATECH designed an IPP program that suited Korea's educational system by compensating for the problems of traditional short-term internship programs and benchmarking North America's cooperative education model. Unlike traditional cooperative education systems, the KOREATECH IPP program has the following five features.

A semester-based quarter system (spring/fall semesters with summer/winter sessions; cooperative education for ten months, six months (one semester plus one session) in the third year and four months (one semester) in the fourth year within a four-year university system). In the case of Korea's universities, most undergraduate programs, except for a few majors such as architecture, can be completed within four years. However, unlike students in North America, the majority of Korean students do not graduate within four years because of military service (for male students), tuition procurement, career preparation, study abroad to improve language skills, and other issues. Given this situation, it was assumed that many students would choose not to participate in a 5-year North American-style IPP program because it would make the period of university enrollment last too long. For this reason, KOREATECH designed a new management system that could provide IPP for a 10-month period while maintaining the basic

four-year course. This involved radically changing the existing semester system (consisting of spring and fall semesters) to a semester-based quarter system (two semesters with summer and winter sessions). Students can graduate within four years, as the new system allows them to compensate for their IPP-related absences by taking courses in their major subject during the seasonal (summer/winter) quarters of their third and fourth years.

Academic credits and tuition payment for IPP. Unlike North American universities, KOREATECH decided to reduce the students' course burdens by offering proper credits for IPP programs. The system gives students up to 15 credits for their 10-month IPP. Because the number of credits necessary to graduate from the KOREATECH College of Engineering is 150, the maximum number of credits (15) is equivalent to 10% of the credits needed for graduation. Our tuition policy is also different from most North American programs, which operate on the principle of, "No credit, no tuition." KOREATECH allows students to pay the same tuition during their participation in IPP. Because students are able to graduate within four years despite taking part in IPP semesters, the IPP system causes no additional financial burden; seasonal quarters focus on major courses, and students may take some courses for free (6-9 credits per seasonal quarter).

Asymmetrical operations during the IPP period. To maximize the educational impact of IPP, KOREATECH divides the 10-month IPP period into two parts: six months for the first IPP and four months for the second IPP. The reason for this is that, during the first IPP period, students need more time to adapt to corporate life, which they are experiencing for the first time. During the second IPP period, students are ready to begin carrying out tasks immediately in their new jobs, having become familiar with corporate/industry environments through the first IPP. In other words, students use the first IPP to explore their skills and possible career paths and to make use of their major subjects; the second IPP is an opportunity to undertake real work, enhancing their employability. From an educational point of view, six months separate the first and second IPP so that students who return from the first IPP feeling motivated to study their major subjects can engage in more advanced studies related to their majors.

Project/task-centered IPP operations. Initially, IPP students select the projects or tasks they would like to undertake, using

the job descriptions offered by corporations. They then apply to those companies offering projects or tasks that reflect their own interests and skills. Finally, they select IPP participating corporations through an interview process. The IPP program, as a system that offers credits, differs from the traditional short-term internship because corporate mentors (or department managers), professors specializing in IPP, and professors in the students' major fields evaluate the students' work and award credits accordingly. Most of the time, the projects are not big initiatives (such as resolving a company's technical problems or solving problems that require a high-level of training), but ones in which the content and scope of the student's work is clearly defined, involving tasks that allow students to identify their duties in advance and successfully navigate cooperative education and assessment.

Preparing for IPP when entering university. The curriculum from the first year has been restructured to meet industry demand, encouraging students to participate in IPP and consider industry demand. Students are encouraged to prepare for IPP upon entrance by taking courses related to career exploration and design. IPP is managed and operated not only to provide cooperative education, but also career development, supporting students in choosing and developing a career. IPP professors (industry-university collaborative professors who belong to the IPP center, which is dedicated to IPP) play a role as career counselors, helping students prepare for careers. The curriculum is continuously improved through the feedback of students and employers who participated in IPP, as well as through performance analyses.

IV. Data Analysis

A. KOREATECH graduates survey overview

KOREATECH investigates graduates' employment status every two years using the questionnaire survey. The last survey was conducted from Nov 23, 2016 to December 23, 2016 for the graduates within the recent five years. Differing from the previous surveys, the last one included some questions regarding the effectiveness of IPP in terms of graduates' employment and job performance for the first time. The

Table 1. Characteristics of respondents

Item		# of respondents	Percentage (%)
Total		730	100.0
Major	Mechanics	130	17.8
	Mechatronics	120	16.5
	Electric, Electronic and communications	123	16.9
	Computer	118	16.2
	Materials	32	4.4
	Applied chemistry	31	4.2
	Architecture	34	4.7
	Design	31	4.2
Status of employment	Industrial management	111	15.2
	Employed	640	87.7
	Not employed	90	12.3
Gender	Female	135	18.5
	Male	595	81.5
Age	Less than 25	6	0.8
	25~29	488	66.8
	More than 29	236	32.3
Year of graduation	2016	208	28.5
	2015	218	29.9
	2014	100	13.7
	2013	100	13.7
	2012	104	14.2
IPP participation	Participants	213	29.2
	Non-participants	517	70.8

respondents' characteristics are summarized in Table 1 by major, status of employment, gender, age, year of graduation, and IPP participation. By comparing response results between IPP participants and non-participants, we tried to guess the extent of influence of IPP on graduates' employment and job performance.

B. Influence of IPP on graduates' academic performance

Table 2 shows that GPA upon graduation of IPP participants was slightly higher than that of non-participants, and the difference was statistically significant at the significance level 0.1. The causality, however, is not clear because most of IPP trainings are conducted during students' senior or

Table 2. Grade point average upon graduation

Item	IPP Participants (n=213)	Non-participants (n=517)	t-value
GPA upon graduation	3.55/4.50	3.49/4.50	1.79 [†]

[†]p<0.1.

Table 3. Length of time in college

Item	IPP Participants (n=213)	Non-participants (n=517)	t-value
Length of time in school	5.78	6.01	-1.85 [†]

[†]p<0.1.

higher years.

Contrary to expectations, IPP participants' average length of time in school was statistically significantly shorter than that of non-participants as shown in Table 3. We guess IPP experiences helped students to get jobs and graduate early under the eccentric Korean situation where students tend not to graduate even after the fourth years until they get proper jobs.

C. Influence of IPP on graduates' employment

The employment rate of IPP participants was 89.7% (n=213), compared with that of non-participants 86.8% (n=517). Although 2.9% is not a significant number, it is meaningful from the perspective of KOREATECH, which already had the highest employment rate of all universities in Korea.

Table 4 shows that IPP participants and non-participants perceived usefulness of field training for employment

Table 4. Perceived usefulness for employment

Item	IPP Participants (n=191)	Non-participants (n=449)	t-value
Short-term field training (less than 2 months)	3.11	2.96	1.72 [†]
Long-term field training (more than 4 months)	3.57	2.99	6.49***

[†]p<0.1, ***p<0.001.

Table 5. Perceived importance of various job characteristics for job decision

Item	IPP Participants (n=191)	Non-participants (n=449)	t-value
Income	4.08	4.04	0.48
Job security	4.14	4.17	-0.43
Working conditions	3.99	4.02	-0.43
Career development potential	4.20	4.02	2.55*
Employee benefits	3.97	3.85	1.64
Job autonomy	3.80	3.67	1.68 [†]
Match with aptitude	4.00	3.89	1.34
Match with major	3.52	3.45	0.79
Social reputation	3.40	3.33	0.83

[†]p<0.1, *p<0.05.

Table 6. Relevance of undergraduate major to current job content

Item	IPP Participants (n=191)	Non-participants (n=449)	t-value
Relevance of major to current job content	3.56	3.55	0.04

Table 7. Post-graduation annual starting salary

Item	IPP Participants (n=189)	Non-participants (n=447)	t-value
Post-graduation annual starting salary	33.45 mil Won	32.42 mil Won	1.22

differently. IPP participants thought that field training is helpful for employment to some degree, but non-participants didn't, and the difference of perception was greater in case of long-term field training than short-term field training.

Perceived importance by graduates of various job characteristics for deciding jobs is represented in Table 5. Among the nine items a statistically significant difference was found for two items: career development potential and job autonomy. IPP participants regarded career development potential and job autonomy more important in their choice of jobs than non-participants.

According to Table 6, there is no statistically significant difference between IPP participants and non-participants in terms of the congruence between undergraduate major and current job content.

The post-graduation annual starting salary of IPP participants was slightly greater than that of non-participants, but the difference was not statistically significant as shown in Table 7.

D. Influence of IPP on graduates' job performance

Table 8 shows there were statistically significant differences between IPP participants and non-participants in perceptions that IPP experiences are useful for job performance after graduation. IPP participants rated the contribution of field training to job performance positively, whereas non-participants didn't.

As shown in Table 9, IPP participants were more satisfied with their current income than non-participants at the significance level of 0.5, although the difference of average annual starting salary between the two groups was not

Table 8. Perceived usefulness of field training for Job performance

Item	IPP Participants (n=191)	Non-participants (n=449)	t-value
Short-term field training (less than 2 months)	3.08	2.81	2.85**
Long-term field training (more than 4 months)	3.37	2.90	4.92***

p<0.01, *p<0.001.

Table 9. Influence of IPP on graduates' job satisfaction

Item	IPP Participants (n=191)	Non-participants (n=449)	t-value
Satisfaction with current job contents	3.74	3.65	1.12
Satisfaction with current income	3.46	3.24	2.48*
Satisfaction with current interpersonal relationships at the workplace	3.86	3.77	1.20

*p<0.05.

Table 10. Influence of IPP on graduates' organizational commitment

Item	IPP Participants (n=191)	Non-participants (n=449)	t-value
If I got another offer for a better job elsewhere, I would consider leaving my organization	3.47	3.46	0.03
I really feel as if this organization's problems are my own	3.39	3.42	-0.41
Too much in my life would be disrupted if I decided to leave my organization now	2.75	2.80	-0.47
My organization deserves my loyalty because of its treatment towards me	3.32	3.24	0.98
Often, I find it difficult to agree with this organization's policies on important matters relating to its employees	2.47	2.64	-2.03*

*p<0.05.

statistically significant. Satisfaction of IPP participants with their current job contents and current interpersonal relationships at the workplace was also greater than that of non-participants, but the differences were not statistically significant.

Among five items relating to organizational commitment, a statistically significant difference was found for only one item as shown in Table 10. That is, IPP participants felt less difficulty agreeing with their organizations' policies on important matters than non-participants. From this result we guess that IPP experiences helped graduates to get adjusted to their organizations. In other four items of organizational commitment, no significant difference was found.

Table 11. Evaluation of graduates' job performance by their superiors

Item	IPP Participants (n=42)	Non-participants (n=120)	t-value
Quantity of job performance	4.07	4.08	-0.03
Quality of job performance	4.07	4.13	-0.39
Speed of job performance	3.90	4.06	-1.07
Precision of job performance	3.98	4.22	-1.82 [†]
Difficulty of job	3.93	4.08	-1.09
Understanding of job	4.05	4.20	-1.14
Contribution to organizational performance	4.17	4.12	0.36

[†]p<0.1.

As shown in Table 11, there were not statistically significant differences in evaluation of job performance by superiors between IPP participants and non-participants except for one item of precision of job performance. That is, superiors of non-participants rated their subordinates' precision of job performance higher than those of IPP participants did at the marginal significance level of 0.1. This result deserves a lot of attention of researchers since it is a kind of negative outcomes that arise from field training.

V. Discussion and Conclusion

In this study impact of KOREATECH IPP program on recent graduates' academic performance, employment, and job performance was analyzed using a questionnaire survey data. We guessed positive or negative influence of IPP experiences on graduates by comparing response results of IPP participants and non-participants.

According to Tables 2 and 3, it is found that IPP program has positive influence on students' academic performance measured by GPA and length of time in school. But a special attention has to be paid to the interpretation of causality because most of students participate in the Co-op program faced with an imminent graduation to get assistance for their employment. In line with this argument, Table 12 shows an interesting result that graduates rated impact of IPP on employment (3.98) higher than on job performance (3.63).

Regarding influence of IPP on employment, it was found first of all that the employment rate of IPP participants was higher than that of non-participants by 2.9% points. Although 2.9% is not a significant number, it is meaningful from the

Table 12. Perceived usefulness of IPP for employment and job performance

Item	(n=200)	Frequency (%)	Five-point scale
Useful to getting jobs	5 (very much)	36.5	3.98
	4	37.0	
	3 (neutral)	19.0	
	2	3.0	
	1 (not at all)	4.5	
Useful to job performance	5 (very much)	20.0	3.63
	4	46.0	
	3 (neutral)	19.5	
	2	6.0	
	1 (not at all)	8.5	

perspective of KOREATECH, which already had the highest employment rate of all universities in Korea. It was also found that IPP experiences affected graduates' perception on the effect of the Co-op program on employment positively and changed their job choice criteria to some extent. However, no significant difference was found regarding congruence between undergraduate major and current job contents, and annual starting salary between IPP participants and non-participants.

In terms of job performance, influence of IPP was mixed. On the one hand it was found IPP experiences affected positively graduates' job satisfaction and organizational commitment to some extent, but on the other, superior ratings on KOREATECH graduates revealed a possible negative side of IPP. This finding indicates there is some room for improvement in KOREATECH IPP program. In this regard, Table 13 gives direction to KOREATECH's efforts. In order to increase contribution of IPP to graduates' employment and job performance, a special attention should be paid to meaningful IPP job design and its matching to students' future career plans.

This study has several limitations. First of all, there should be

a longitudinal study in order to judge the effectiveness of IPP program more correctly. Although this study surveyed alumni of recent five years to increase the reliability of the result, a cross-sectional analysis is intrinsically prone to erroneous conclusion. Second, the number of survey respondents should be increased. Especially, more superiors are needed to get more reliable result regarding job performance of IPP participants after graduation. Finally, many other factors are expected to affect employment and job performance of IPP participants, thus more sophisticated statistical analyses like the logistic regression analysis are recommended to control unintended influences in the future.

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References

[1] C. K. Parsons, E. Caylor, and H. S. Simmons, "Cooperative education work assignments: The role of organizational and individual factors in enhancing ABET competencies and Co-op workplace well-being," *Journal of Engineering Education*, vol. 94, issue 3, pp. 309-318, July 2005.

[2] M. K. Schuurman, R. N. Pangborn, and R. D. McClintic, "Assessing the impact of engineering undergraduate work experience: Factoring in pre-work academic perfor-

Table 13. Reasons why IPP is useful or not

Item	Reasons	Five-point scale	
IPP is useful to getting jobs	Yes (n=147)	Understand jobs and organizational life	4.11
		Understand competencies required for jobs	3.86
		Differentiate from non-participants	3.81
	No (n=53)	Too simple tasks	3.32
		Not able to identify my aptitude	3.19
		No support from mentors	3.13
IPP is useful to job performance	Yes (n=132)	Help to understand and adjust to fields	4.15
		Help to enhance social skills	3.98
		Help to increase practical skills	3.45
	No (n=68)	Mismatch between current and IPP jobs	3.69
		Mismatch between major and field practice	3.25
		Simple support tasks	3.19

mance,” *Journal of Engineering Education*, vol. 97, issue 2, pp. 207-212, April, 2008.

- [3] B. F. Blair, M. Millea, and J. Hammer, “The impact of cooperative education on academic performance and compensation of engineering majors,” *Journal of Engineering Education*, vol. 93, issue 4, pp. 333-338, October 2004.
- [4] A. A. Rezin, *A Comparison of Industry Success of Associate Degree Graduates Who Participated in Cooperative*

Apprenticeship Programs versus their Counterparts in Traditionally Delivered Programs, Unpublished Doctoral Dissertation, The Ohio State University, Columbus, 1998.

- [5] Y. Tanaka, *Evaluating the Effectiveness of Career-oriented Education at Work: An Analysis based on Questionnaires to Alumni*, Center of Research and Development for Cooperative Education, Kyoto Sangyo University, Kyoto, Japan, 2012.



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