An International Comparison of the Effect of Work-integrated Learning on Academic Performance: A statistical evaluation of WILs in Japan and Hong Kong

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Abstract

As the popularity of WIL grows, there is a pressing need for introducing standard and more quantitative methods for evaluating these programmes, by which the effective components of WIL can be comparatively discerned over time as well as between different institutions and over national frontiers. The present paper applies a simple statistical method to the data obtained in Japan and Hong Kong, based on and updated from Tanaka and Matsutaka (2010) and Carlson (2010). The paper discusses how to make comparable the different data obtained from different socio-cultural and economic environments of different countries, using the cases of Japan and Hong Kong.

A regression analysis is employed to statistically analyze several thousand panel data of students graduating in 2010 from KSU and PolyU. Because WIL is organized differently in these institutions, the direct comparison is difficult. For example, the KSU WILs are optional and therefore we can measure the direct effect of WIL. In contrast, the sampled are the first cohort of PolyU students who were required to complete WIL. The effect of WIL is shown to have statistical significance for PolyU, while for KSU it is not significant for the 2010 sample although it is significant for 2008 and 2009. On the other hand, the effect of pre-university achievement on academic performance at university were significant and had a similar magnitude at KSU and PolyU.

Overall, it is also expected that this statistical framework can be applied to assess WIL programmes in other institutions and countries. In this specific case, the KSU and PolyU programmes serve as useful contrast to learn more about the processes, supports, and outcomes of programmes in different institutional and national contexts.
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Introduction

As the popularity of WIL grows, there is a pressing need for introducing standard and more quantitative methods for evaluating these programmes, by which the effective components of WIL can be comparatively discerned over time as well as between different institutions and over national frontiers. Several papers have appeared in the recent WACE conferences to deal with the quantitative assessments of WIL such as Green (2009), Matsutaka, Tanaka, and Churton (2009), Carlson and Kwan (2010), Mendez (2010), and Tanaka and Matsutaka (2010). Matsutaka, Tanaka, and Churton (2009) examined the students’ awareness and its effects on their academic as well as employment outcome, using a sample of over 1300 students at a Japanese University. Carlson and Kwan (2010) investigated the effects of WIL on learning used a sample of 1040 students from a university in Hong Kong. Although with much smaller and specific students group, Green (2009) and Mendez (2010) looked into a group of engineering students to verify the effect of work placement on academic performance in British Universities. Despite the sample size variation and international/regional
difference, they all employed a regression analysis as a statistical tool to deal with the students data and all these studies concluded that the WIL acted as a positive factor in determining the academic and non-academic outcome. However, comparing studies of such a variation requires extra caution before accepting the result. In particular, there are three aspects that require standardization, namely; a measurement of academic/non-academic outcome, a feature of WIL, and a statistical method including data specification.

The present paper offers an example of such a comparison, using a simple statistical method to the data obtained in Japan and Hong Kong, based on and updated from Tanaka and Matsutaka (2010) and Carlson and Kwan (2010). The paper discusses how to make comparable the different data obtained from different socio-cultural and economic environments of different countries, using the cases of Japan and Hong Kong. A regression analysis is employed to statistically analyze several thousand panel data of students graduating in 2010 from KSU and PolyU. Because WIL is organized differently in these institutions, the direct comparison is difficult. For example, the KSU WILs are optional and therefore we can measure the direct effect of WIL. In contrast, the sampled are the first cohort of PolyU students who were required to complete WIL.
Overall, it is also expected that this statistical framework can be applied to assess WIL programmes in other institutions and countries. In this specific case, the KSU and PolyU programmes serve as useful contrast to learn more about the processes, supports, and outcomes of programmes in different institutional and national contexts.

The paper proceeds as follows. Firstly, the basic theoretical framework and statistical method are introduced. This will be followed by analyses of Japanese data and Hong Kong data in turn, with each section introducing the background of the university and its WIL programmes, basic features of data used, and statistical results. Discussion summarises the result of KSU/PolyU comparison and calls for developing further a standard approach to assess WIL programmes.

**Hypotheses**

The theme of this paper is to determine the effects of WIL on students’ academic performance during undergraduate years. Therefore our main hypotheses would be;

**Hypothesis 1: “WIL raises academic performance.”** However, even if we can prove a strong correlation between WIL and academic performance by, for example, comparing whether or not a student takes WIL and his/her GPA, sceptics may argue that those students with WIL were good academic performers in the first place, thereby negating the positive effect of WIL on the academic performance, i.e. good students do
take WIL as well as achieving high GPA. In order to tackle this issue, we introduce another hypothesis;

Hypothesis 2: “Good students do well at university, anyway.” If this were true, all our effort to improve the students’ performance with WIL would be meaningless. So it is important to clarify that our effort is worthwhile by somehow negating this hypothesis.

In fact, this line of argument is all very familiar to labour economists by the concepts of “human capital investment” and “signalling” in labour economics. Human capital investment is a concept to explain one’s decision to pay for education in the expectation that his/her productivity and wage will rise in future, just as in monetary investment. For example, one decides to go to university as long as his/her wage differential with a high school leaver is greater than the cost of university education he/she has to pay.

Some argue, however, that education is a credential rather than capital formation (or raising productivity) and consider it as signalling. The idea is that people are different and we do not have perfect information about the difference among them, so that a job seeker needs an educational credential to “signal” his/her productive ability, or equivalently a recruiting firm needs to “screen” the applicant’s productive ability. There is a large volume of theoretical as well as empirical research in labour economics in this
issue. [For example, see Becker (1964) for the original work on human capital theory, Spence (1973) for an intuitive and clear introduction of signalling, and Borjas (2008) for introductory treatment of the both.]

Empirically, however, it is difficult to differentiate the human capital effect and signalling effect of education, since the both raises one’s employment outcome, i.e. one could get a good job based on receiving education because he/she becomes productive through human capital formation and/or because the prospective employer recognizes his/her innate productivity. Likewise, academic performance is higher for those taking WIL because WIL raises academic performance and/or able students take WIL. We therefore construct the hypotheses 1 and 2 as above, where the former examines the effect of WIL on academic performance be it human capital or signalling, while the latter examines its signalling effect --- if it holds WIL is more likely to be signalling.

**Statistical approach**

We employ a regression to estimate the effects of WIL and background academic ability with the sample students other attributes also taken into consideration. Therefore, the equation to estimate would take the following linear equation form;

\[ Y = a_0 + b_1X_1 + b_2X_2 + b_3X_3 + X_4 \]
where **Dependent variable**

Y: the academic performance in the final year, e.g. Final year GPA or grade average

**Independent variables**

X1: the pre-university academic performance, e.g. High school grade or First year GPA

X3: WIL, e.g. 1 if taken and 0 otherwise, or duration or a number of placements,

X4: student’s attributes, e.g. Faculty, sex,

And in order to make the results of two cases comparable, we used;

(1) Average GPA in the 3\(^{rd}\) year (GPA3) for Y: For PolyU, we use the average GPA in the 3\(^{rd}\) year as it is the final year. In contrast, Japanese universities offer four year undergraduate programmes. But most of the students acquire necessary credits for graduation by the end of third year and the final year is largely spent to look for a job. As a result, we believe that the 3\(^{rd}\) year academic performance reflects one’s academic result more appropriately.

(2) Average GPA in the 1\(^{st}\) year (GPA1) for X1: Pre-university exam data are available for PolyU but there is no such standardized data in Japan. Therefore, we use the
average GPA in the 1st year to reflect pre-university academic performance.

(3) Dummy variable or numbers for X3: It is optional in KSU as in most of Japanese universities, in which case dummy variables and a number to count the number of WIL courses are used, while PolyU offers a mandatory so instead the number of placements and student reported learning gains and experiences are used.

(4) Faculty dummy and male/female dummy for X4

The equation could take forms other than log-linear. But to make analysis simple we use a linear equation. We use an Ordinary Least Square method to estimate the equation. Again a Maximum Likelihood Estimation method is available, too. In the following chapters, we use these theoretical framework and estimation method to analyze the effect of WIL on academic performance in universities in Japan and Hong Kong in turn.

**Case I: Kyoto Sangyo University**

**Backgrounds of university and WIL**

Kyoto Sangyo University was founded in 1965 and is a medium sized private university in Japan with over 13,000 students among 7 faculties (with 2 more in 2010). Since 1999, KSU has been offering to its students a range of career education courses based on domestic internships. But the significant step was taken when the government
approved and funded our new project on career education in 2004 and the Center of Research and Development for Career Education was set up. Since then, the programme expanded and as of 2009 there are 20 courses. Of the 20 courses, 11 are Work-integrated Learning courses, in which students have direct contacts with industries, while 9 are inductive courses to nurture students towards working life.

**Basic data**

The data has been collected from 2478 undergraduate students who graduated in 2010. This figure excludes 109 students whose GPA data were not available because of temporary withdrawal. Of the total 2478, 1747 were male and 671 were female from 7 faculties i.e. Economics, Business, Law, Foreign Languages, Culture, Science, and Engineering. Average GPAs for 1st and 3rd years were 1.80 and 1.91 respectively. 1st year’s GPA may be used to represent the student’s academic ability before coming to university. This is because we can not trace detailed data on students’ pre-university academic performance in Japan. 3rd year’s GPA is used to identify the academic progress during the undergraduate years instead of the 4th year, due to a rather peculiar Japanese situation where many students manage to attain the necessary credits to graduate by the end of 3rd year to spend almost an entire 4th year for job search, so that their 4th year’s GPAs do not reflect their ability. Career education as a whole has the
total number of registrations of 3156, with 491 in WIL courses, which offer direct
contacts with companies through internships, and 2739 in inductive courses, which
introduce to students various aspects of working life. In terms of student number, 309
took WIL course and 1505 took inductive courses, while 773 took none.

Ordinary Least Square estimation was performed for the following equations with a
variation in the independent variables.

Eqn 1: GPA3=Constant+b11~b16(Faculty)+b2(Sex)+b3(GPA1)

Eqn 2: GPA3=Constant+b11~b16(Faculty)+b2(Sex)+b3(GPA1)+b4(CE)

Eqn 3: GPA3=Constant+b11~b16(Faculty)+b2(Sex)+b3(GPA1)+b5(WIL)

Eqn 4: GPA3=Constant+b11~b16(Faculty)+b2(Sex)+b3(GPA1)+b6(Ind)

Eqn 5: GPA3=Constant+b11~b16(Faculty)+b2(Sex)+b3(GPA1)+b5(WIL)+b6(Ind)

where Faculty: Faculty dummy, CE: Career Education, Ind: Induction

The results appear in Table 1. The adjusted R squared of 0.398 and F statistics of
between 164.801 and 205.921 suggest that overall the estimation results are reliable. As
for individual variables, Faculty dummies --- note that they are differences from Faculty
of Engineering, which does not appear with dummy variable, show varying signs and
level of significance. One might suspect that the grading system is not consistent over
faculties. Female students seem to do better in earning higher GPA in the 3rd year than male students by just below 0.1 given the same set of attributes and significantly so.

Our main concern, however, is the effects of pre-university performance and WIL upon the academic performance after several years of university education, or the effects of GPA1 and other WIL variables on GPA3. GPA1 shows a very significant result with coefficient of around 0.584 in all 5 equations, which means that given the same set of variables a student with 1 point higher GPA1 is likely to have 0.584 point higher GPA3. This may be interpreted as “how you start university determines just over half of your university achievement.” This would support Hypothesis 2 in that “good students do well at university anyway” but at the same time there is a room for others to catch up, too.

Three variables are used to measure the effect of WIL on GPA3. Career education refers to a number of WIL related courses taken, while WIL and Induction are dummy variables and refer to more extensive WIL and inductive courses respectively.

The results about the effect of WIL on GPA3 are rather discouraging. While most of them show the positive signs as expected, none of them shows significance. Hence Hypothesis 1 that “WIL raises academic performance,” cannot be supported. This result
is rather odd because when we look at 2008 and 2009 cohorts and run the same regressions, they show significantly positive estimates for WIL (See Table 3).

Case II: Hong Kong Polytechnic University

Background of university and WIL

The Hong Kong Polytechnic University throughout its history has been an application-oriented educational institution. Prior to attaining full university status in 1994, it was both a Polytechnic and even longer in its history a Technical College. PolyU is the largest government funded tertiary institution in Hong Kong with a total of 28,000 students (about 15,000 are in government-funded programs). Given this history, WIL has a long record at PolyU in those programs where professional qualifications and licensure are required. However, this history is not pervasive across all students and programs. In the 2005/6 Academic Year, PolyU admitted its first cohort that was subject to a compulsory WIL requirement. Each student under this requirement must have at least one WIL placement at least equivalent to two full working weeks (e.g., 80 hours).

Basic data

The data was collected from a WIL exit survey with an overall response rate of 45.5%. A total of 1373 undergraduate students who graduated in 2010 are the sample. Of the
total, 807 are male and 566 are female and from six faculties and two schools ---

Faculty of Applied Science and Textiles, Faculty of Business, Faculty of Construction
and Land Use, Faculty of Engineering, Faculty of Humanities, Faculty of Health and
Social Science, School of Hotel and Tourism Management, and School of Design.

Average GPAs for the 1st and 3rd years were 2.96 and 3.16 respectively. WIL is
mandatory in PolyU as explained earlier, and thus we cannot determine its effect on
academic performance with one/zero dummy variable. In order to express the WIL
experience of each student, Number of Placements, Overall Learning Outcomes and
Overall Contextual Rating are used to measure the effect of WIL. Number of
Placements simply refers to the number of WIL placements a student worked during
WIL with the maximum 18, minimum 1, and the average 2.01 per student, although a
large majority of them have 1 or 2. Overall Learning Outcomes and Overall Contextual
Rating are derived from a student survey given to students upon graduation. Overall
Learning Outcomes is a student rating of WIL placements created by adding 1 to 5
ratings of 14 individual specific outcomes plus 1 overall item. With the maximum of
150 points and the minimum of 15 points, the average is 108.29. Overall Contextual
Ratings is another student rating created by adding 1 to 6 ratings of 10 contextual
variables related to successful learning in WIL placements. With the maximum of 60 and the minimum of 10, the average is 44.06.

Ordinary Least Square estimation was performed for the following equation;

\[ \text{GPA3} = \text{Constant} + b_{11} \sim b_{117} (\text{Faculty dummy}) + b_2 (\text{Sex}) + b_3 (\text{GPA1}) + b_4 (\text{No of Placements}) + b_5 (\text{Overall Learning Outcomes}) + b_5 (\text{Overall Contextual Rating}) \]

And the result appears in Table 2.

The adjusted R-squared of 0.402 and F statistics of 57.958 suggest that overall the estimation results are reliable. As for individual variables, Faculty dummies --- note that they all are differences from School of Design, which does not appear with dummy variable, generally do not show a significant result apart from Faculty of Construction and Land Use. This one difference is hard to interpret without more investigation.

Female students seem to do better in earning higher GPA in the 3\textsuperscript{rd} year than male students by 0.05 given the same set of attributes and significantly so.

Our main concern, however, is the effects of pre-university performance and WIL upon the academic performance after several years of university education, or the effects of GPA1 and other WIL variables on GPA3. GPA1 shows a very significant result with coefficient of 0.574, which means that given the same set of variables a
student with 1 point higher GPA1 is likely to have 0.574 point higher GPA3. This may be interpreted as “how you start university determines just over half of your university achievement.” This would support Hypothesis 2 in that “good students do well at university anyway” but at the same time there is a room for others to catch up, too.

The result about the effect of WIL on GPA3 is somewhat mixed. Overall Learning Outcomes shows that its effect on GPA3 is positive and significant, i.e. beneficial WIL placements that produce better student learning outcomes raise academic performance, which support Hypothesis 1 that “WIL raises academic performance.” Yet the coefficients of a number of placements and Overall Contextual Rating show negative signs although they are not significant. The former may suggest that having too many placements does not help generate good academic performance. As for the latter, it is likely a suppressor variable – as this variable has a very small yet positive bivariate relationship to GPA3.

Discussion

This paper attempted to compare WIL programmes of different countries --- probably one of the first attempts to do such evaluative international comparisons of WIL. Even when we compare mere two countries such as Japan and Hong Kong, there are
problems to solve in order to make it a meaningful comparison. For example, what can we use to measure the pre-university academic ability? Or, how do we compare WILs of different formats? In this sense, this paper’s treatment is far from the ideal. Yet there is no doubt that the benefit of such an attempt clearly outweighs the problems, especially for the practitioners and advocates of WIL programmes who hope to spread the concept globally.

With respect to the comparison made in the paper, interesting results arose. Hypothesis 2 was supported in Japan and Hong Kong, with very similar values of around 0.5~0.6 in the both, suggesting GPA1 contributes to a half of GPA3. It would be interesting to see if this value holds for other countries, too. Hypothesis 1 was met with mixed results but not necessarily negative. It is left to the future research to determine whether this was due to inappropriate measures or ineffective WIL. Again, involving more countries may help to verify the point.

Finally, the theoretical framework and methodology employed in this paper were based on economic analysis. But this by no means implies to exclude approaches of other disciplines such as Psychology and Sociology. It is hoped that we will eventually develop a standard approach with which the practitioners and advocates of WIL can collaborate globally.
References


