The International Education Journal: Comparative Perspectives Vol. 13, No. 1, 2014
http://iejcomparative.org

Gains in learning outcomes of college students in Japan: Comparative study between academic fields

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Ensuring gains in the learning outcomes of college students has become a major concern for Japanese higher education institutions. In recent decades, national and public as well as private universities have been forced to embed learning outcomes into their curriculum. A number of studies have shown that the learning outcomes of students are strongly associated with the quality of pedagogy and student experience. This paper aims to understand the association between college experiences and degree of learning among academic fields using data collected in nationwide student self-report surveys, the JCIRP. The findings suggest that faculty engagement and student experience play pivotal roles in the acquisition of knowledge and skills. Based on the findings of this study, it is suggested that pedagogical approaches should be improved by embedding aspects of interactive teaching and learning in the classroom setting and in the whole curriculum.

Keywords: academic fields, faculty engagement, learning experience, learning hours, learning outcomes

INTRODUCTION

Today, higher education institutions around the word are required to take increasing responsibility for the quality of their education outcomes; quality assurance and accountability issues have become common concerns for higher education institutions the world over. Zumeta (2011) defines accountability as "responsibility for one's actions to someone, or to multiple parties, as a result of legal, political, financial, personal, or simply moral ties" (p. 132). The general public is becoming more involved with higher education institutions, and is critical when it is not satisfied with the effectiveness and the performance of the institution. Consequently, demonstrating quality and institutional accountability by achieving clearly stated educational outcomes has become important (Ewell, 2007). Japanese higher educational institutions are not exempt from these modern demands. A reform movement has emerged, as highlighted in new Ministry of Education, Culture, Sports, Science and Technology (MEXT) policies. The Central Council for Education (CCE) report, *Future of Japanese higher education*, declared the 21st Century as the age of the knowledge-based society and, in such a society, achieving high-quality educational outcomes are important for both individuals and the nation (MEXT 2005). Hence, higher education policy in Japan has shifted, in this decade, from research-centred to teaching- and learning-centred. Another CCE report, published in 2008, was revolutionary in the sense that it confirmed this policy shift. The report, *Toward the construction of undergraduate education* (MEXT, 2008), urged Japanese universities to set common learning outcomes for tertiary education students as one method for meeting the quality assurance requirements of globalization. Common learning outcomes are called "graduate attributes" and include: generic skills, such as communication,

quantitative skills, information literacy, logical thinking and problem solving; intercultural-multicultural knowledge, human culture, society and the natural world; and social skills, such as teamwork, collaboration, and leadership (MEXT, 2008). Since the 2008 CCE report, assessing the types of college environment that accelerates student experience and leads to good learning outcomes has become a national concern for Japan.

In recent decades, Japanese Universities have been forced to embed learning outcomes into the curriculum of many of their units regardless of academic field. Studies have shown that the learning outcomes of students are positively associated with the quality of pedagogy and student experience (Pascarella & Terenzini, 2005; Ogata, 2008). Building on such studies, this paper explores the association of college experiences with degree of learning among academic fields. This study used quantitative methods to analyse data collected in nationwide, self-report surveys of students: the Japanese College Student Survey (JCSS) 2010 and the JCIRP Freshman Survey (JFS) 2008. The surveys are part of a series administered by the JCIRP (Japanese Cooperative Institutional Research Program), which are designed to obtain information about upper and lower division students attending Japanese universities.

DEVELOPMENT OF JAPANESE COOPERATIVE INSTITUTIONAL RESEARCH PROGRAM (JCIRP)

Banta (2004) suggests that there are two kinds of assessments for measuring student learning outcomes: direct and indirect assessments. Direct assessment gauges the direct learning outcomes of students through tests, essays, portfolios, graduation examinations, graduation research papers and standardized tests in both general and discipline-based education. Indirect assessment gauges the learning process, using student surveys about learning behaviors, student experiences, self-perception and satisfaction. When used in tandem, indirect and direct assessments complement one another, offering a broad picture of college outcomes (Gonyea, 2005).

Over the years, much research has been conducted and much debate has ensured concerning the efficacy and accuracy of student assessment in countries such as the US and Australia (Coates, 2010). Many researchers have dedicated their work to measuring, testing and assessing student learning outcomes and have developed various tools for gauging the cognitive, educational, and affective progress of students. Many questions on the reliability and validity of self-report student surveys, often used by the researchers, have arisen (Borden & Young, 2007). Nevertheless, a growing body of empirical evidence shows that self-report student surveys are a valuable method for assessing learning outcomes and the college experience of students (Anaya, 1999; Kuh et al, 2001; Gonyea, 2005; Coates, 2010). Consequently, several standardized student surveys to assess college outcomes and experience have been designed (Shavelson, 2010). The Cooperative Institutional Research Program (CIRP) and National Survey of Student Engagement (NSSE) are two self-report surveys widely used in the US (Kuh, 2004; Pascarella & Terenzini, 2005). In Japan, however, few well-researched assessment tools have been developed. That is, Japanese student surveys are often designed and applied without underpinning theory to aid in their validity (Yamada, 2008). This situation differs markedly from that in the US, where both direct and indirect assessment tools have been devised using in-depth research and extensive theory.

Since 2004, we have been developing student survey assessment tools that stress the developmental model of affective and behavioral experiences of student life. With the approval of HERI (Higher Education Research Institute) at UCLA (University of California Los Angeles), we developed a Japanese version of the College Student Survey, called the Japanese College Student Survey (JCSS), and the JCIRP Freshman Survey (JFS). These surveys are specialized version of

the CIRP (Cooperative Institutional Research Program) and CSS (College Student Survey) developed at HERI that features numerous items—developed specifically for Japanese student, which gather information about learning behaviors, experiences, values, motivations, and student self-assessment. In 2008, we developed the original Japanese Junior College Student Survey (JJCSS). The theoretical background for the survey is based on the work of Astin, who, in 1966, firs proposed college impact theory, which predicts student outcomes through a consideration of multiple factors. Astin (1985, 1993) examines the origins and processes of student change and growth throughout their college lives. Many researches have since used college impact theory as a framework for gaining a better understanding of student growth through college life (Tinto, 1993; Pascarella & Terenzini, 1991, 2005).

As already noted, at present, in Japan, more than ever, teaching and learning have gained new emphases. It is imperative to refine methods of indirect assessment and apply research finds improve teaching and learning in Japanese higher education. One of the basic purposes of the JCIRP is to become the method for conducting indirect assessment of college impact on student growth. A set of qualitative and quantitative methods were used to validate the JCIRP before and after application: the qualitative methods included pilot studies with focus groups and expert review; the quantitative methods included item response analysis for the questionnaire items and reliability analysis. These methods were similar to those used for validation of assessment instruments in the US (Kuh, 2004). After conducting the survey in Japanese institutions, our research team analysed the data and produced a report for each of the participating institutions. In turn, the institutions provided us with feedback on the ways in which we might improve the survey and our reporting of results. This process helped us to improve the reliability and validity of the surveys. As shown in Table A1 (Appendix), more than 105,000 students from 678 institutions have participated in the three different surveys conducted by the JCIRP in the eight years to 2012. These surveys are carried out on a voluntary basis by each institution. Consequently, some participants in the three surveys belong to the same institution; but the majority are recruited from different student populations and different institutions each year. Thus, JCIRP surveys provide cross-sectional information and are not designed to be longitudinal surveys which follow the same respondents over the course of several years.

LITERATURE REVIEW OF LEARNING OUTCOMES

Learning outcomes can be measured on the basis of external effects—that is, efficacy outside the formal educational system—or by internal effects, also called “college impact”, showing the learning outcomes of students as a result of the quality of pedagogy and student experiences. A theory of college impact does not concentrate on any individual process of students’ growth; rather, it focuses on the contexts in which a student acts and thinks. Institutional structures, policies, programs, and services, as well as attitudes, values and the behaviors of others in institutional environments, are all aspects of student growth (Pascarella & Terenzini, 2005; Klein, Chun, Hamilton, & Shavelson, 2005; Lambert, Terenzini, & Latuca, 2007; Lichtenstein, McCormick, Sheppard, & Puma, 2010). Pascarella and Terenzini (2005) have suggested that the institutional structure has both an indirect and direct influence on student development; it includes the college environment, the quality of student effort and students’ interactions with other students and the faculty.

Several Japanese studies that focus on learning outcomes of college students in Japan. Murasawa (2003), Kuzuki (2006) and Ogata (2008) asked what kinds of knowledge and skills do college students obtain through college life. They found that obtained knowledge and skills differ

depending on academic fields (disciplines). Yamada (2008, 2009) found that upper division students (junior and senior years of undergraduate education) had acquired more knowledge, both generally and in their academic fields, than lower division students (first-year students). By the time students are promoted to upper division, differences grow between the sciences and the arts fields. While students in the arts acquire more general knowledge associated with global and cultural knowledge, students in the sciences acquire more knowledge of their fields. Further, Yamada (2008) found that the degree of satisfaction with the college experience of upper division students is higher than that of lower division students.

Furuta (2010) confirmed that there were clear differences in knowledge and skills attainment, depending on academic fields (disciplines). He further suggested that students in the arts (the humanities and the social sciences) tended to self-evaluate higher than students in the sciences (the natural sciences and engineering) in terms of obtained knowledge and skills. However, these studies did not delineate how the different student experiences among academic fields contribute to the degree of perceived obtained knowledge and skills.

In a study examining the impact of academic fields, Pascarella and Terenzini (2005) found that a person's major course of study had a selective impact on the development of general cognitive skills. A student's cognitive growth was greatest on measures where the content was most consistent with that student's academic field. Other studies affirm the significance of the academic field for student development (Coates & Ainley, 2007; Marks & Coates, 2007).

Although these studies outside Japan have clarified that the association of various student experiences in and outside the classroom have positive impacts on learning outcomes, it is questionable whether the findings obtained can be applied to Japanese students studying in specific academic fields. The studies carried out by Furuta (2010), Murasawa (2003), Kuzuki (2006), Ogata (2008), and Yamada (2008, 2009) did not show how different pedagogies and student experiences in different academic fields affect their learning outcomes. Tanimura (2009, 2010) focused on how differences of pedagogy and class structure in three academic fields[1] influence learning hours and learning outcomes. The studies showed that the health science field, which is tightly coupled with the qualification system in Japan, is distinctive.

This study aims to clarify how different pedagogies and student experiences in different academic fields across national/public and private institutions affect their learning outcomes. Findings from this study shed light on how Japanese universities deal with interactive teaching and learning issues in today's knowledge-based society from not only theoretical but also a practical base.

RESEARCH OBJECTIVES

This study is part of a nationwide research effort to understand the association of college experiences with the degree of learning among academic fields. The study also examined whether learning hours differ between academic fields. The CCE report published in March 2012 (MEXT, 2012), asserted that average learning hours of students should be eight hours per day (including inside and outside class learning hours) but the actual average learning hours of Japanese students is 4.6 hours a day. The report also points out that the number of learning hours of students in the social sciences field are relatively low compared to those of the natural and the health sciences. Overall, policymakers are concerned that Japanese students engage in relatively fewer learning hours than US students.

[1] Tanimura classified academic fields into three areas: humanities & social sciences, STEM and health sciences.

In recent decades, national and public universities have been forced to embed learning outcomes into their curriculum in order to deal with accountability requirements. Private universities, which have faced a decrease in student numbers, have voluntarily followed suit. Many Japanese universities have introduced a variety of programs, including active learning and other experiences. Such programs are expected to contribute to increased knowledge and skills. In a changing environment, in which Japanese universities are becoming much more teaching centred, it is imperative to update the general profile of Japanese students. Following the approach of a nationwide study (MEXT, 2012), we examined the variations in learning hours among the different academic fields and asked how college experiences contribute to learning outcomes in both public and private universities. This study also explored whether there are differences in the experiences of students attending the three different types of universities: national (administered by the national government), public (administered by local government), and private institutions.

The JCIRP, a continuous and standard self-report survey, made it possible to delineate trends and changes in student college experiences. Thus, as well as obtaining general trend information about student college experiences, the following specific research questions were examined;

- Are there differences between academic fields and between types of institution in obtained knowledge and skills?
- Are there differences in college experiences among academic fields?
- What are the possible causes of the differences in obtained knowledge and skills among academic fields and between lower and upper division students?

The determinants of obtained knowledge and skills were also explored.

METHOD

Instrument and research framework

This study employed a quantitative research design using data obtained from JCSS2010. JCSS2010 is a series of JCIRP designed to obtain data from upper division students. It consists of 36 items and 299 variables, including college experiences, satisfaction, self-evaluation for learning outcomes and student background. In order to compare degree of satisfaction between lower division students and upper division students, JFS2008 data consisting of 35 items and 207 variables was also used in this study.

Multiyear self-reported student data can be used to examine important questions. The arrows shown in Figure 1 represent: (A) cohort comparisons; (B & C) longitudinal comparisons; and (C & D) cross-sectional comparisons. Thus, interpretation and analysis of results based on a model illustrated in Figure 1 can clarify environmental factors that affect learning outcomes of students. The data from JFS2008 can be matched to the data of JCSS2010 for the same institution (Figure 1, Line B), enabling long-term comparison. Some questionnaire items, such as degree of satisfaction, match completely between JFS2008 and JCSS2010. Thus, if there is a difference between satisfaction of lower and upper division students in the same academic fields of the same universities, it is possible to explore the factors that cause the difference.

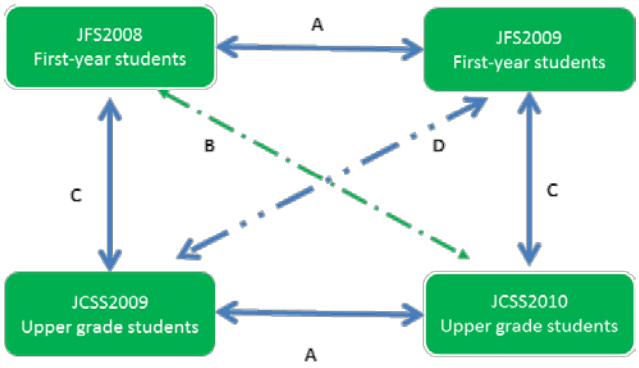

Figure 1: The JCIRP data set and analysis model

JCSS2010 and JFS2008, as with other self-report surveys, have validity and reliability limitations. Kuh et al. (2001) argues that self−report measures are likely to be valid if employed under five conditions: the information is known to respondents; the questions are phrased clearly and unambiguously; the questions refer to recent activities; the respondents think the questions merit a serious and thoughtful response; and answering the question does not threaten, embarrass, or violate the privacy of the respondent or encourage the respondent to respond in socially desirable ways. Our JCIRP research group discussed the contents of items and reviewed them for each year. After the review process, we eliminated inappropriate items and added necessary items. Thus, consistent attempts were made to ensure that JCSS2010 and JFS2008 met the five criteria and provided accurate and meaningful information about students' experiences and learning outcomes.

The research framework aimed to examine the relationship between learning environment and learning outcomes among academic fields, as illustrated in Figure 2. Although input factors, such as performance and experiences in high school, directly and indirectly influence learning outcomes, this study focused particularly on the relationship of environmental factors: type of institutions, academic fields, faculty engagement, student experiences, and affective and cognitive outcomes. Thus the framework illustrated by the dashed line in Figure 2 will be examined.

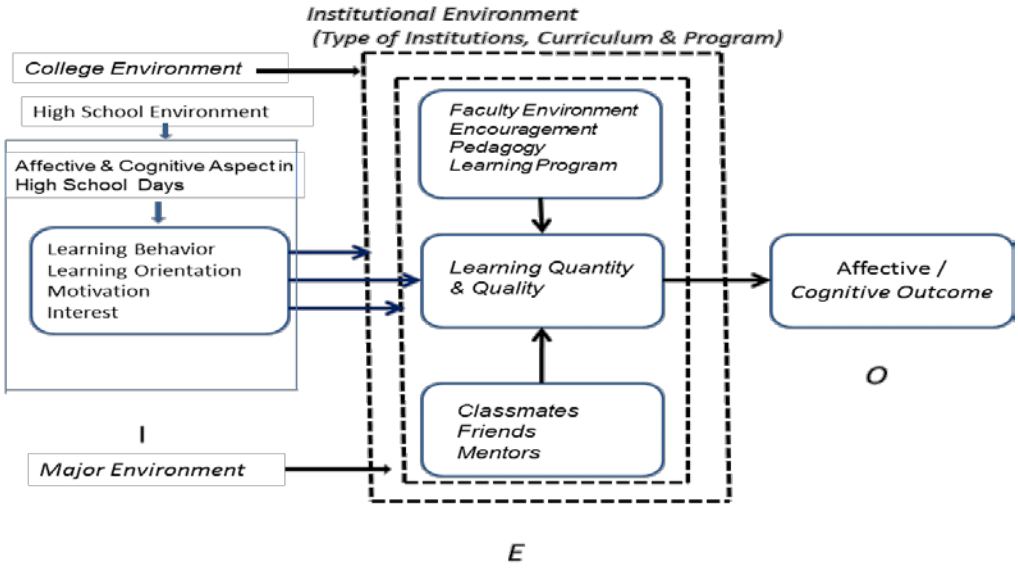

Figure 2: Research framework

RESULTS

Profile of Respondents

Total respondents of the JCSS2010 survey were 8,300 from 82 institutions (17 national, 6 public and 59 private universities). Respondents from national and public universities accounted for 28.5 per cent of respondent and those from private institutions 71.5 per cent. Since these proportion align with those of the School Basic Survey, which is a national survey that MEXT requires students to complete every year, the JCSS2010 data appeared to represent the general profile of Japanese college students. Academic fields included were: 15.5 per cent, humanities; 41.5 per cent, social science; 16.1 per cent, natural sciences and engineering; 23.8 per cent, health sciences; and 3.1 per cent, others. The proportion of female respondents, at 56.8 per cent, was higher than that of male students but, based on the School Basic Survey (MEXT, 2012), the proportion of female students who actually attend university for four years was 41.7 per cent. Female respondents, therefore, are over-represented in the survey sample. We assumed that this gender imbalance in the survey sample is, in part, because most respondents in the health sciences are female students of nursing.

Figure 3 shows that there are differences in number of learning hours outside class time by academic fields. As described above, the issue of student's learning hours outside class time has become the subject of heated discussion. Japanese universities employ a credit system and, usually, 124-128 credits are required to obtain a bachelor's degree after four years at university. The University Establishment Standard requires a total of 45 hours of learning; that is, students are required to study 15 hours in class and 30 hours outside class per one credit per semester. As noted by Kaneko (2013), students are obliged to study eight hours a day inside and outside class except on Sundays. It should also be noted that, although the JCSS2010 includes questions regarding learning hours inside and outside of class, it does not include any additional items regarding the content of this learning. Thus, there is no information about what, specifically, students learn outside of class. However, as is evident from Figure 3, the learning hours of Japanese students falls short of the University Establishment Standards. Students in the health sciences, and natural sciences and engineering attend more classes than students in the humanities and social sciences (MEXT 2012). Differences in in-class learning hours between academic fields, therefore, exists. Of greater concern to MEXT, however, are the differences among academic fields in learning hours outside of class.

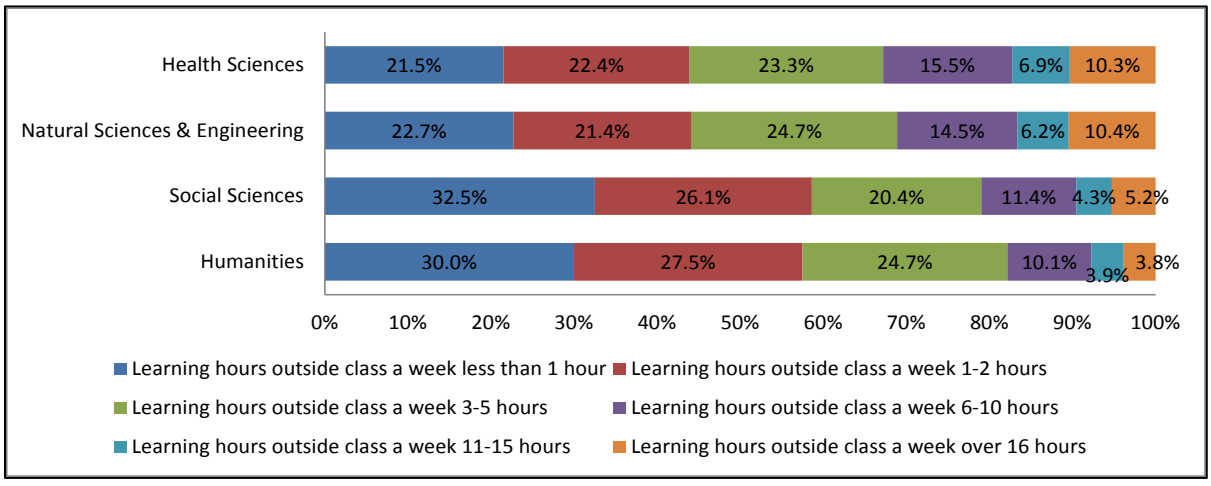

Figure 3: Learning hours outside class by academic fields

As the report by the CCE (MEXT, 2012) points out, students in the medical sciences, natural sciences and engineering tended to study longer hours than those in the humanities and the social sciences. The question emerges whether the differences in learning hours among academic fields lead to differences in learning outcomes. It should be understood that learning hours is only one variable that affects the learning outcomes of students.

The dependent variables in this study are the learning outcomes of Japanese undergraduate students in three areas: *interpersonal skills*, *classic knowledge and skills*, *contemporary knowledge and skills*. Similar to the method used in earlier studies by Pascarella and Terenzini (2005), we examined the association of college environment and learning outcomes. Learning outcome items were made up of 20 items scored on a 5-point Likert scale related to how much students' learning outcomes improved over the course of the students' undergraduate education. Using factor analysis, we extracted four factors with factor loadings greater than 0.400. Principal axis factoring using the varimax method resulted in a 56.6 per cent cumulative contribution. Four factors were identified from 19 items. We labelled the factors: *interpersonal skills*, including the items "skill to build human relation (.840)," "skill to carry things out in cooperation with other people (.784)," "communication skill (.762)," "leadership ability (.640)", and "skill for time management (.505)"; *classic knowledge and skills,* comprising "knowledge of particular academic fields (.731)," "analytical and problem-solving skills (.669)," "general knowledge (.619)," "critical thinking skill (.547)," "IT skill (.500)," "writing skill (.419)," and "oral presentation skill (.418)"; *contemporary knowledge and skills* comprise "knowledge of people of different cultures (.695)," "skill to cooperate with people of different cultures (.691)", "understanding of issues your community faces (.683)," and "understanding of issues your nation faces (.655)"; *basic skills* comprise "mathematical skill (.707)" and "foreign language skill (.673)." The Alpha reliabilities of these 4 scales are .80, .76, .80 and .72 respectively, with all four over .72.

Based on previous research findings, the independent variables of this study were categorized as control variables (i.e. student input variables) and process variables. Control variables included gender, institutional type and academic field.[2] Process variables included students' experiences related to learning inside and outside class, active learning and their adjustment to university education. Also included were variables related to faculty engagement in students' activities and students' satisfaction regarding university education.

Gender was included as a dummy variable taking a value of 0 for male and 1 for female. Institutional type was also a dummy, coded 0 for private universities and 1 for national and public universities. Academic fields were categorized into four groups: the humanities, the social sciences, the natural sciences and engineering, and the health sciences. The health sciences were treated as a reference field group. A humanities variable was dummy coded with academic fields in the humanities taking on a value of 1 and all other fields taking on a value of 0. Academic fields in the social sciences, and the natural sciences and engineering were similarly dummy coded, with academics fields in a category receiving a value of 1 and all other fields receiving a value of 0. Descriptive statistics for the dependent and independent variables used in this study are presented in Table A2 of the appendix.

[2] The variable, institutional type, is divided into: national & public universities, and private universities. National universities (national university corporations) and public universities (established by local prefectural governments) are collapsed into one code: national & public universities. Academic fields are divided into four fields: Humanities, Social Sciences, Natural Sciences & Engineering, and Health Sciences. Humanities include literature, religious studies, history, languages etc. Social sciences include economics, political sciences, sociology, education, policy studies and psychology. Natural Sciences and Engineering include natural sciences, biology, mathematics, technology and agriculture. Health Sciences include medicine, nursing, and other health services.

Of the three academic fields, students in the humanities had the highest scores on learning outcomes for *interpersonal skills*, *classic knowledge and skills*, and *contemporary knowledge*. While students in the natural sciences and engineering scored high for *basic skills*, their self-evaluation scores on *interpersonal skills* and *contemporary knowledge and skills* are the lowest of the four academic fields (Table 1). We assume that the sciences and engineering curriculums are more systematically structured than those of the social sciences and the humanities; science and engineering students must deal with theories, concepts and study within laboratories. The highest score for *basic skills* achieved by the students in the sciences and engineering reflects the systematic structure of the curriculum and the teacher-centred approach of the field. This finding is in line with those of Malek et al. (2012) who found that students in the natural sciences are exposed to more abstract concepts, such as theories, and, thus, were more likely to experience teacher-centred approaches. While there is insufficient evidence to demonstrate a positive association between high scores in basic skills and a teacher-centred approach, it is clear that the teacher-centred approach is utilized more frequently in the so-called hard sciences to teach various concepts and theories.

Table 1: Mean scores of learning outcomes and ANOVA by academic fields

	Humanities		Social Sciences		S T E M		Health Sciences		Maximum Score	DF	F
	Mean	SD	Mean	SD	Mean	SD	Mean	SD			
Interpersonal Skills	18.39	2.93	18.04	3	17.89	3.1	18.04	2.9	25	3	6.27*
Classical Knowledge and Skills	26.5	3.1	25.9	3.5	26.4	3.3	25.6	3.4	35	3	25.2*
Contemporary Knowledge and Skills	17.67	2.7	17.24	2.6	16.76	2.5	16.48	2.5	25	3	63.4*
Basic Skills	6.2	1.4	6.1	1.4	6.7	1.4	6.1	13	10	3	65.4*

*p<.001

The curricula of the humanities and the social sciences have more flexibility, and an interactive approach to learning can be observed in class. We assume that differences in classroom settings explained differences in knowledge and skills obtained.

The results of a two-way ANOVA for three factors of learning outcomes (Table 2) showed significant interaction effects between institutional type and academic fields for obtaining *interpersonal skills* (F=3.243 p<.05) and *classic knowledge and skills* (F=22.99 p<.001). Regarding the acquisition of *interpersonal skills*, while students of the humanities and the social sciences at national and public universities score higher than those at private universities, students of the natural sciences, engineering and the health sciences at private universities score higher than those at national at public universities. Similarly, in terms of obtaining *classic knowledge and skills*, humanities and the social sciences students at national and public universities had higher skills than students at private universities; whereas students of the natural sciences, engineering and the health sciences at private universities had higher scores than those at national and public universities. The higher score of students of the natural sciences, engineering and the health sciences at private universities might be explained by the fact that, in the past, national and public universities received more financial assistance from national or local government for enhancing facilities and equipment, and private universities did not. Thus, to compete, natural science and engineering fields at private universities, which were often established later than

those of the public and national universities—and with fewer resources, concentrated on improving quality of teaching.

Table 2: Results of two-way ANOVA for three learning outcomes

Academic fields		Humanities		Social Sciences		Natural Sciences and Engineering		Health Sciences	
		National and Public	Private	National and Public	Private	National and Public	Private	National and Public	Private
Interpersonal Skills	Mean	18.71	18.33	18.19	17.97	17.71	18.05	18.02	18.05
	SD	2.814	2.951	2.909	3.043	3.153	2.98	2.832	2.911
Classic Knowledge and Skills	Mean	27.7	26.3	26.72	25.55	26.3	26.46	25.26	25.64
	SD	2.801	3.143	3.208	3.499	3.196	3.44	3.61	3.289
Contemporary Knowledge and Skills	Mean	18.44	17.54	17.5	17.12	16.95	16.58	16.66	16.44
	SD	2.369	2.754	2.51	2.663	2.478	2.516	2.654	2.453

	Main effect				Interaction	
	Institutional type		Academic field			
	Mean	p	Mean	p	Mean	p
Interpersonal Skills	0.408		6.492	***	3.243	*
Classic Knowledge and Skills	24.689	***	31.094	***	22.99	***
Contemporary Knowledge and Skills	35.303	***	53.373	***	2.409	

*p<.05, ***p<.001

Regarding differences in student classroom experience or in engagement with faculty between academic fields, Table 3 shows how often a student-centred pedagogical approach is used in the classroom setting. Since the maximum score of each item is 5, a student-centred pedagogical approach appeared not to be frequently used in the classroom for any of the academic fields; but there are differences. Students in the humanities and the health sciences tended to critically review their own literature and materials more often than students in the social sciences, natural sciences and engineering. Students in the humanities scored highest in presenting their own ideas and research than students in other academic fields. The reason might be that class sizes in the humanities fields are relatively small and, thus, more interactive methods can be used. The scores for learning useful knowledge and skills for work were highest for students of health science. The reason might be that the curriculum content for the health sciences is closely linked to actual skills used in the workplace. Students of the natural sciences and engineering, as well as in the health sciences tend to learn experientially through experiment and practice—probably because the learning environment of those academic fields introduces more opportunities for practical, hands-on learning activities. Teaching assistance was highest in the natural science and engineering fields; perhaps because the fields involve many graduate students to help teach undergraduate students. Assignments in many academic fields were not returned to students with corrections and comments. There was little difference among the three academic fields of humanities, social sciences and health sciences for the items: “students discuss with each other during class”, “student’s opinions are incorporated in class”, and “students set the themes to be discussed in class”. Although these pedagogies appear to cultivate students’ independence, these are rarely introduced in Japanese classes.

Table 3: The degree of usage of student-centred pedagogy in the class

	Total		Humanities		Social Sciences		Natural Sciences & Engineering		Health Sciences	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Students examine their own literature and materials	2.98	0.82	3.14	0.77	2.90	0.81	2.99	0.78	3.04	0.84
Students present their ideas and research	2.78	0.78	3.04	0.70	2.79	0.76	2.60	0.77	2.76	0.79
Students learn experientially through experiment and practice	2.67	0.97	2.32	0.95	2.51	0.93	2.92	0.92	3.00	0.95
Students learn useful knowledge and skills for work	2.65	0.89	2.32	0.82	2.63	0.84	2.33	0.78	3.09	0.88
Students discuss with each other during class	2.60	0.82	2.69	0.82	2.65	0.79	2.33	0.78	2.73	0.84
Papers are returned to students with corrections and comments	2.51	0.82	2.50	0.80	2.41	0.83	2.63	0.77	2.57	0.82
Student's opinion is incorporated in class	2.44	0.79	2.51	0.78	2.49	0.79	2.28	0.76	2.43	0.80
Teaching assistants help in a class	2.30	0.95	1.91	0.90	2.25	0.90	2.89	0.84	2.25	0.95
Students set the theme to be discussed in class	2.17	0.83	2.26	0.86	2.21	0.82	1.95	0.78	2.18	0.84

Maximum score is 4

Results of multiple regression analysis

We used multiple regression analyses to determine the best predictors of variables of educational effect on learning outcomes. Environmental factors were represented by institutional environment: type of institution, curriculum and programs. We observed that faculty often encourage students and offer advice. We hypothesized that faculty engagement with students as well as their teaching methods contribute to the smooth adjustment of students to college life and leads to good learning outcomes. Student experience on learning, both quantitatively and qualitatively, was hypothesized to closely relate to learning outcomes. Based on the research framework depicted in Figure 2 and, having examined the correlation coefficients, we entered the variables into a multiple regression model. Three dependent variables: *interpersonal skills*, *classic knowledge and skills*, and *contemporary knowledge and skills*, were selected, based on the result of factor analysis of learning outcomes. The Female, Institutional Type and Academic Field dummies were utilized as control variables.

The results, summarised in Tables 4, 5 and 6, indicated that there were several common, significant determinants of the learning outcomes: *interpersonal skills*, *classic knowledge and skills*, and *contemporary knowledge and skills* (shown by grey shading in the three tables). Each of the predictor variables was found to be significant at the $p < .001$ level. Among the independent control variables, the humanities dummy variable was found to significantly predict all three learning outcomes. Combined, these predictors accounted for 26.0 per cent of the variability in *interpersonal skills* outcome, 24.7 per cent of the variability in *classic knowledge*

and skills outcome, and 14.5 per cent of the variability in *contemporary knowledge and skill* outcome. Regression analyses revealed that the environmental factors: "skills to manage your time effectively", "deepen friendship with other students", "students present their ideas and research", "learning hours outside class in a week" significantly predict all three dependent variables. Faculty engagement variables: "help students in improving their academic skills", and "students learn useful knowledge and skills for work" were also found to be predictive of learning outcomes.

Table 4: The results of multiple regression analysis for learning outcome: *interpersonal skills*

Variable	B	β	*t*	p
Female dummy	-0.39	-0.007	-0.59	0.557
Institutional dummy	0.026	0.004	0.361	0.718
Humanities dummy	0.417	0.051	3.979	0.000
Social sciences dummy	0.271	0.045	3.454	0.001
Natural sciences & engineering dummy	0.163	0.01	1.536	0.125
Skill to manage your time effectively	0.848	0.234	21.62	0.000
Deepen friendship with other students	0.841	0.235	21.55	0.000
Students present their ideas and research	0.254	0.066	4.985	0.000
Learning hours outside class in a week	0.072	0.041	3.745	0.000
Help students in improving their academic skills	0.146	0.045	3.597	0.000
Students learn useful knowledge and skills for work	0.172	0.051	4.116	0.000
Students discuss with each other during class	0.213	0.059	4.534	0.000
Quiz and paper are required in a class	0.21	0.049	4.483	0.000
To become acquainted with faculty	0.264	0.075	6.453	0.000
R^2=.262 Adjusted R^2=.260				

Table 5: The results of multiple regression analysis for learning outcome: *classic knowledge and skills*

	B	β	*t*	p
Female dummy	-0.475	-0.07	6.278	0.000
Institutional dummy	0.388	0.052	4.719	0.000
Humanities dummy	1.161	0.137	10.513	0.000
Social sciences dummy	0.688	0.101	7.678	0.000
Natural sciences & engineering dummy	0.728	0.081	6.009	0.000
Skill to manage your time effectively	0.649	0.158	14.481	0.000
Deepen friendship with other students	0.284	0.07	6.363	0.000
Students present their ideas and research	0.462	0.106	7.942	0.000
Learning hours outside class in a week	0.295	0.149	13.4	0.000
Help students in improving their academic skills	0.293	0.08	6.297	0.000
Students learn useful knowledge and skills for work	0.302	0.08	6.336	0.000
Student examine their own literatures and materials	0.236	0.57	4.608	0.000
Quiz and paper are required in a class	0.439	0.088	7.885	0.000
Give academic advice and guidance	0.174	0.49	3.86	0.000
Satisfaction for overall quality of education	0.115	0.04	3.818	0.000
R^2=.249 Adjusted R^2=.247				

Table 6: The results of multiple regression analysis for learning outcome: *contemporary knowledge and skills*

	B	β	*t*
Female dummy	-0.136	-0.026	-0.0117
Institutional dummy	0.372	0.064	5.457
Humanities dummy	1.235	0.172	12.418
Social sciences dummy	0.891	0.169	12.618
Natural sciences & engineering dummy	0.415	0.59	4.14
Skill to manage your time effectively	0.32	0.1	8.606
Deepen friendship with other students	0.186	0.059	5.05
Students present their ideas and research	0.295	0.087	6.137
Learning hours outside class in a week	0.105	0.068	5.76
Help students in improving their academic skills	0.183	0.065	4.763
Students learn useful knowledge and skills for work	0.176	0.06	4.454
Students discuss with each other during class	0.229	0.072	5.149
To become acquainted with faculty	0.25	0.08	6.464
R^2=.147 Adjusted R^2=.145			

Although the Female dummy and Institutional dummy were not found to be significant, the Humanities and the Social Sciences dummy were observed to significantly predict the acquisition of *interpersonal skills.* Environmental factors: "students discuss with each other during class", "to become acquainted with faculty", and "quiz and paper are required in a class" were also found to affect the acquisition of *interpersonal skills*.

All control independent variables were found to significantly impact *classic knowledge and skills* acquisition. Male students at national and public universities obtained more *classic knowledge and skills*. In terms of how academic fields predict these learning outcomes, as opposed to the health sciences as a reference group, the humanities, social sciences and natural sciences and engineering academic fields were found to be positively associated with *classic knowledge and skills acquisition*. In addition to the common student experience variables mentioned above, the student experience variable, "students examine their own literatures and materials" was also found to be predictive of *classic knowledge and skills acquisition*. These results indicated that student experience variables predict the acquisition of *classic knowledge and skills*. The faculty engagement variables: "quiz and paper are required in a class" and "give academic advising and guidance", and "satisfaction with overall quality of education" also predicted the acquisition of *classic knowledge and skills*.

Institution and academic field variables significantly predict acquisition of *contemporary knowledge and skills*. Students in the humanities, the social sciences and natural sciences and engineering at national and public universities were found to acquire more *contemporary knowledge and skills* than those of the health sciences. The student experience variables: "students discuss with each other during class", "to become acquainted with faculty" all affected the acquisition of *contemporary knowledge and skills*.

The observation that academic field significantly predicts all three learning outcomes supports our hypothesis that acquisition of knowledge and skills differs among academic fields.

Variables related to student experiences were strong predictors for the acquisition of all learning outcomes. The findings of the regression analysis confirmed that longer hours of learning and active experiences yielded a higher score on learning outcomes.

THE DIFFERENCE BETWEEN JFS2008 AND JCSS2010

Finally, we examined the question of whether there is a difference between lower and upper division students in cross-sectional academic fields by using JFS2008 and JCSS2010 data. The number of students with the same academic field and university who participated in both JFS2008 and JCSS2010 was 3,482 (first year students) and 2,142 (junior and senior). Both surveys included the same comprehensive items of degree of satisfaction. The faculty- and course-related items were extracted for analysis.

Although the scope of inference of the survey results was limited, upper division students appeared to be more satisfied with more items than lower division students. Across all academic fields, upper division students showed lower satisfaction for two items, "relevance of course content to daily life", and "general education" than lower division students. This result is in line with previous study results that showed the existence of "relative effectiveness of upper division" (Yamada, 2009). However, some differences among academic fields were observed. Forty per cent of both lower- and upper-division health sciences students showed a higher degree of satisfaction for the question asking "effectiveness of course content for career plan". But the degrees of satisfaction for the other four questions asked of upper division students were not as high as that of students of other academic fields. While 40 per cent of lower division students were satisfied with general education, only 25 per cent of upper division students indicated satisfaction with their general education. Students in the humanities, and the natural sciences and engineering students showed higher degrees of satisfaction with general education.

These results delineate the learning environment around the health sciences: the curriculum and programs of the health sciences are strongly influenced by occupational qualification requirements, hence, there is less flexibility for students to select courses voluntarily. On the other hand, students in the humanities are able to select courses with flexibility; and in the upper division, they tend to choose courses that really interest them. Strong motivation for taking a course appears to result in a higher degree of satisfaction. This result is in line with Porter's (2006) finding identifying those institutional structures, including institutional density and differentiation in the curriculum, that influence student experiences.

Table 7. The degree of satisfaction for the selected items

	Humanities		Social Sciences		Natural Sciences & Engineering		Health Sciences		All academic fields*	
	JFS2008	JCSS2010	JFS2008	JCSS2010	JFS2008	JCSS2010	JFS2008	JCSS2010	JFS2008	JCSS2010
Opportunity to talk with faculty	33.8	32.8	24.1	27.5	22.2	26.6	24.7	27.4	26	31.1
The number of students per class	32.3	39.3	26.4	30.2	24.8	34.1	24.2	34.1	27.7	34.8
Relevance of course content to daily life	33.1	28.9	29.6	28.5	23.1	20.7	33.4	24.4	29	26.8
Effectiveness of course content for career plan	23.1	31.9	29.3	30.7	22	22.8	41.6	38.9	28.5	31
Quality of overall education	36.6	44.4	29.1	32.9	26.7	33.4	33	32	30.7	36
General education	46.8	50.1	42.9	38.2	37.3	38.8	39.5	24	41.4	38.9

proportion of satisfied + very satisfied

*all academic fields include other areas such as performing arts and home economics

DISCUSSION AND CONCLUSION

In addition to the previously discussed items, six items, scored on a 4-point Likert scale,[3] were included in the survey to gain information about adjustment to the college environment. Students in all academic fields scored the item of "deepening friendship with other students" highest. One of the key elements of adjustment in the college environment in every academic field is to get along with other students. Students in all academic fields scored the item "to become acquainted with faculty" second. Based on these two answers, human relationships and networking are regarded as pivotal elements for students in adjusting to the college environment. A small difference was observed between students in the hard sciences (natural sciences and engineering, and health sciences) and students of the social sciences and humanities regarding the items as "obtaining effective time management skills" and "learning strategy skills".

Faculty engagement in student learning was also explored. Eleven items focussing on faculty engagement, scored on a 4-point Likert scale, were included in the survey. The items related to how much faculty was engaged in or helped students improve their skills and adjust to undergraduate education.[4] The data shows that almost 50 per cent of the faculties in all academic fields give advice on student learning in their classes and courses as well as help students to improve their academic skills, though the faculties of the natural sciences and engineering are more frequently involved in overall student learning improvement activities than those of other academic fields. While the percentage proportion of providing an opportunity for participation in a research project was less than 20 per cent for the three academic fields, 35.9 per cent of faculties of natural sciences and engineering provide an opportunity for students to participate in a research project. Also, 45.9 per cent of the hard science faculties help students in achieving their professional goals, compared with 37 per cent of the other three academic fields.

This study aimed to clarify the effects of the university environment on learning outcomes. The results supported previous findings that there is an association between institutional environment and learning outcomes, as illustrated in the research framework (Figure 1). Further, the results provide a new insight, showing that some differences in obtained learning outcomes are due to curriculum structure and the pedagogical approaches used in each academic field and institutional type. More specialized as well as systematic programs in the natural sciences and in engineering require more technical tuition, and hence faculties tend to be more engaged in helping students' learning. However, the result of the effects of college experience on learning outcomes indicates that there are commonalities of the effects for three types of knowledge and skills. Students' experiences and faculty engagement appear to play pivotal roles in their acquisition. Several implications can be drawn from this result, one of which is that the pedagogical approach should be improved by embedding aspects of interactive teaching and learning in the classroom setting and in the whole curriculum. The results indicate that improving the pedagogical approach could lead to improvements in both quantitative and qualitative student experiences in learning.

[3] 1 = much weaker to 4 = much stronger.

[4] These 11 items are: "encourage to pursue graduate/professional degree", "providing an opportunity in a research project", "give emotional support and encouragement", "write a letter of recommendation", "provide feedback about your academic work", "give intellectual challenge and stimulation", "provide an opportunity to discuss coursework outside of class", "help in achieving your professional goals", "give academic advising and guidance to students", and "help students in improving their academic skills".

An interesting result from the panel data analysis of 2008 and 2010 was that that degree of satisfaction for quality of education and other learning environments differs among academic fields. Students of the humanities, in which the curriculum is more flexibly structured, were more satisfied than students in the natural sciences, engineering and the health sciences, in which the curriculum is systematically structured. This result suggests that self-motivated engagement may be more effective than forced-engagement. The result of a greater satisfaction among upper division students than lower division students is identical to that found in the Yamada's (2008) earlier study. However, more empirical research should be conducted to clarify whether self-motivated engagement of upper division students brings about greater satisfaction.

Japanese universities have recently endeavoured to improve pedagogy and curricula for proactive learning of students. Continuing the accumulation of longitudinal, self-report data of students is necessary in order to study how the college environment accelerates the quality and quantity of student learning, and leads to improved learning outcomes. Through a better understanding of how and what students learn, Japanese universities can develop new pedagogical approaches and curricula.

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APPENDIX

Table A1. Number of JCIRP participants

	Number of Universities Participating JCSS	Number of Students Participating JCSS	Number of Universities Participating JFS	Number of Students Participating JFS	Number of Universities Participating JJCSS	Number of Students Participating JJCSS
2004	14	1491				
2005	8	3961				
2007	16	6512				
2008	N/A	N/A	163	19661	9	1966
2009	24	4183	69	8534	30	7244
2010	82	8300	N/A	N/A	23	7369
2011	N/A	N/A	119	10913	34	12151
2012	58	5780	N/A	N/A	29	7102
Total	202	30227	351	39108	125	35832

Total number of universities until 2012:678
Total number of students participation until 2012: 105167

Table A2. Descriptive statistics for all independent and dependent variables

Independent variables	**Number**	**Mean**	**SD**
Student input variables (control variables)			
Female dummy	8157	0.57	0.50
Institutional dummy	8300	0.29	0.45
Humanities dummy	8001	0.15	0.36
Social Sciences dummy	8001	0.41	0.49
Natural Sciences & Engineering dummy	8001	0.16	0.37
Health Sciences as a reference group	1904		
Process variables			
Student related variables			
Learning hours outside class in a week	8170	3.59	1.69
Attending hours for class and experiment in a week	8127	5.82	2.04
Skill to manage your time effectively	8218	2.54	0.82
To become acquainted with faculty	8225	2.68	0.84
Deepen friendship with other students	8229	3.16	0.83
Feel bored in a class	8221	3.02	0.72
Satisfaction for the quality of overall education	8221	3.26	1.21
Faculty related variables			
Students present their ideas and research	8247	2.78	0.78
Students discuss with each other during class	8244	2.60	0.82
Students examine their own literature and materials	8211	2.98	0.82
Students learn experientially through experiment and practice	8189	2.67	0.97
Students learn useful knowledge and skills for work	8215	2.65	0.89
Teaching assistants help in a class	8204	2.30	0.95
Quiz and paper are required in a class	8220	3.26	0.67
Give academic advising and guidance to students	8125	2.35	0.94
Help students in improving their academic skills	8135	2.25	0.92
Dependent Variables			
Interpersonal skills	8061	18.02	2.98
Classic knowledge and skills	8041	25.95	3.39
Contemporary knowledge and skills	8056	17.00	2.61