Disciplinary differences and implications for the development of generic skills: a study of engineering and business students' perceptions of generic skills

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History: received: 2017-09-05 accepted: 2018-04-04

ABSTRACT

Although previous research has examined how generic skills and disciplinary contexts are related, such investigation has not been conducted from students' perspectives. Implications of disciplinary differences for the design of a generic skills curriculum have also remained unexplored. In this study, a questionnaire was administered to 502 first-year engineering and business students from a Hong Kong university which explored their perceived importance and competence level of their generic skills, as well as their motivation towards developing these skills. The results of engineering and business students were compared which revealed some disciplinary differences. Substantial differences were found in the importance and competency ratings on IT skills and business students gave significantly higher importance ratings on most generic skills than engineering students. This study will help guide curriculum design that leverages the benefits of interdisciplinary programmes and incorporates generic skills as part of learning outcomes within disciplinary contexts.

KEYWORDS: Generic skills; employability; higher education; curriculum design; interdisciplinary

Introduction

With[AQ4] employers expressing concerns over the job-readiness of university graduates, higher education is now taking the responsibility for nurturing and developing a variety of competencies of students, which encompass work-related generic skills, values and attitudes that are beyond disciplineary knowledge Chan 2012[AQ5]. These generic skills include skills such as critical thinking, problem-solving and communication, and values and attitudes such as respect for others and intercultural awareness. 'Generic skills' is used interchangeably with other terms such as 'employability skills', 'transferable skills' and 'graduate attributes'. It is used in this paper in order to convey the sense that these skills can be applied across disciplines and professions, as well as in life and study. Generic skills are not just skills and attributes desired by employers but are useful and even essential for whole-person development. Despite efforts to promote the importance of generic skills and incorporate the cultivation of students' generic skills in curriculum reforms around the world, the negative attitudes of teachers and students have impeded the development and implementation of generic skills in higher education.

Among university academics and teachers, there is a perception that the responsibility to develop students' generic skills does not rest with the university which should focus on the teaching of disciplinary knowledge (Bennett, Dunne, and Carré 1999; Star and Hammer 2008). The emphasis on research and publication outputs which determine promotion has made teachers prioritise their research activities over teaching (Drummond, Nixon, and Wiltshire 1998; Jung and Chan 2017). On the part of students, their perspectives can sometimes be very short-sighted. Later-year students tend to focus on academic achievements, while younger students are not aware of the immediate importance of generic skills (Dunne, Bennett, and Carré 1997; Arevalo et al. 2010). The examination-oriented culture in Asia also encourages students to focus on academic achievements at the expense of whole-person development (Leung, Leung, and Zuo 2014). Students often perceive developing generic skills as 'time-consuming' given the already heavy workload from their disciplines.

Every discipline has its own characteristics and culture, including academic knowledge, pedagogical practice and the generic skills that embrace it. Traditionally in some faculties such as Engineering, disciplineary knowledge is seen as more important than generic skills (Leckey and McGuigan 1997). For degrees or qualifications that lead to professional accreditation such as engineering and accounting, the weight given to technical content is even stronger as learning outcomes are more aligned with the accreditation requirements, despite some of the generic skills being part of the requirements. There is therefore resistance to incorporate generic skills teaching from teachers and students who prefer to focus on technical content or professional accreditation competencies (Oliver 2013).

Even though generic skills should be transferable across disciplines, some studies have found that generic skills can only be conceptualised and developed within disciplinary contexts (e.g. Jones 2007, 2009a, 2009b; Badcock, Pattison, and Harris 2010; Sweetman, Hovdhaugen, and Karlsen 2014; Bunney, Sharplin, and Howitt 2015). If generic skills are not put into context, it is difficult for students to become fully aware of the need to develop these competencies that can be applied to future workplace. Course curriculum, therefore, should integrate generic skills integral to disciplines.

While previous studies have noted the disciplinary differences in generic skills, what these differences mean for incorporating generic skills development into academic curriculum has remained largely unexplored. By way of an analysis of questionnaires completed by first-year engineering and business students in a research-intensive university in Hong Kong, the aim of this paper is twofold. Firstly, existing research has tended to employ cross-disciplineary models (Jones 2009a, 2009b; Badcock, Pattison, and Harris 2010; Gimenez 2012) to examine how generic skills and disciplinary contexts are related, but such investigation has hardly been conducted from the students' perspectives (Jones 2013). The present study seeks to explore students' perceived importance of generic skills in the engineering and business disciplines, their self-ratings on their competency level in the competencies and their motivation towards developing generic skills. Secondly, the study also aims to provide insights into how generic skills should be promoted in curriculum design in order for students to fulfil the university educational aims and accreditation criteria and, more importantly, to become a global citizen for the society.

Literature review

Generic skills in engineering

In engineering, the types of generic skills recognised are often determined by accreditation bodies. For example, engineering

degree programmes following the criteria of the Accreditation Board for Engineering and Technology (ABET) (2017) are supposed to ensure that student learning outcomes are informed by these generic skills: "an ability to function on multidisciplinary teams", "an understanding of professional and ethical responsibility", "an ability to communicate effectively" and "a recognition of the need for, and an ability to engage in life-long learning". Other frameworks that advise on the generic skills expected of an engineering graduate include the Competencies of Engineering Graduates (CEG) Project (Male, Bush, and Chapman 2011), which aims to promote the understanding of both technical and non-technical skills of professional engineers. Examples of generic skills identified in the CEG project are communication and critical thinking, alongside with others such as problem-solving, teamwork and self-management. In Hong Kong, the accreditation body, the Hong Kong Institution of Engineers (HKIE), adopts the same generic learning outcomes of ABET as outlined above given that both bodies are under the Washington Accord.

Abdulwahed et al. (2013) conducted an extensive review of the literature on the generic skills identified in engineering education around the world. Besides the frequently cited skills as aforementioned, they also acknowledged the relevance of several literally business-related items such as "business and management skills", "entrepreneurship skills" and "decision making skills" (Abdulwahed et al. 2013). In engineering education, some researchers believe that generic skills should be incorporated into students' learning activities. For example, providing students with practical experience to interact with people from diverse disciplines and backgrounds can develop their teamwork skills (Male, Bush, and Chapman 2011). Moalosi, Oladiran, and Uziak (2012) also suggested that engineering students could develop generic skills through learner-centred approaches such as project-based learning, which encourage students to actively make use of their prior knowledge and technical skills.

Recent findings on engineering students' perceptions of generic skills include that of Direito, Pereira, and Duarte (2012), who found that engineering students generally recognised generic skills as important to the professional practice of engineering. They showed that engineering students tended to rate the importance of generic skills more highly than their self-efficacy levels in those same competencies, which coincides with the findings by Chan, Zhao, and Luk (2017). Other researchers such as Passow (2012) further investigated the relative importance of generic skills as defined by ABET, based on a sample of 4225 graduates from 11 different engineering departments. These graduates completed their degree programmes within 10 years prior to the time of Passow's study. It was found that these graduates from across the different divisions of engineering regarded teamwork, communication, data analysis and problem-solving skills most highly.

Generic skills in business

Types of generic skills in business are set out by accreditation bodies such as the Association to Advance Collegiate Schools of Business (AACSB) International. This non-profit organisation accredits management, business and accounting programmes around the world. Institutions following the AACSB criteria need to ensure that their student learning outcomes capture students' development of skills such as "'written and oral communication", "ethical understanding and reasoning", "analytical thinking", "information technology", "interpersonal relations and teamwork", "diverse and multicultural work environments", and "reflective thinking"' (AACSB 2016, 32–33). Also internationally recognised is the European Foundation for Management Development (EFMD), whose publication entitled *European Quality Improvement System (EQUIS)* emphasises the general education aims to develop transferable intellectual skills, including the abilities to "analyse, synthesize and critically assess complex material", "formulate and defend independent judgments", "conceptualise" and "communicate effectively in writing and orally" (EFMD 2017, 22). The Association of Chartered Certified Accountants (ACCA) also includes a number of behavioural attributes expected of a Finance Professional in its Competency Framework, including "Communicator", "Credible", "Problem Solver", "Supporting Others" and "Acting ethically and legally" (ACCA 2013).

Accounting students' self-perceived levels in generic skills are often researched in relation to employers' expectation. Jackson (2012) examined the self-perceived levels of 1024 business undergraduates in generic skills and revealed the disparity between their self-ratings and the expectation of their industry counterparts. According to Jackson (2012), such a disparity not only indicated a mismatch between students' self-perceived level of competence and employers' expectations but also the failure of higher education to deliver pedagogical strategies that would encourage students to self-evaluate critically their learning outcomes of generic skills. The development of students' competencies alone is not sufficient and does not automatically mean that students would be capable to transfer these developed competencies to the context of workplace (Jackson 2013). In their study, Jackling and De Lange (2009) showed that while accounting employers in Australia sought from their employees skills such as teamwork, leadership, interpersonal and communication skills, accounting graduates held different perceptions, thinking that employers only valued "accounting problem analysis" and "key accounting skills" (Jackling and De Lange 2009, 376). Ameen, Jackson, and Malgwi (2010) also found that accounting students did not perceive effective communication of financial information as a professional responsibility, while accreditation bodies ascribed high importance to this skill.

Work-integrated learning (WIL) is often suggested as a useful learning activity that helps to facilitate students' understanding of the link between their academic studies and future career. For example, Freudenberg, Brimble, and Cameron (2011) presented a professional development programme that was integrated into a business degree (majors in Accounting and Financial planning). They reported that students enrolled in the programme made more significant progress in developing their generic skills than those who did not participate in the programme. The WIL experience might have positively influenced the students' perception of generic skills (Freudenberg, Brimble, and Cameron 2011). A related finding is that of Paisey and Paisey (2010) who collected and compared the feedback from post-placement accounting students to that of students enrolled in a similar university programme without a work placement component and concluded that work placement was facilitative of students' generic skills development.

Generic skills across disciplines

Researchers who attempt to clarify the effect of disciplinary contexts on students' development of generic skills include Jones (2009a, 2009b), who established cross-disciplineary studies that involved the five disciplines of history, physics, economics, law and medicine. She demonstrated that generic skills were conceptualised and taught differently among these disciplines, and hence argued that disciplinary cultures and disciplinary epistemologies had an impact on how generic skills were developed among students. This raises the question of whether generic skills should be embedded accordingly to the different natures of each of the disciplines in higher education.

To evaluate participants' levels of generic skills including critical thinking, interpersonal understandings, problem-solving and written communication, Badcock, Pattison, and Harris (2010) administered a graduate skills assessment (GSA) to a sample of 323 undergraduate students from three disciplines: arts, science and engineering in an Australian university. The GSA is a "five-scale, objective measure of undergraduate students' generic skills levels" (Badcock, Pattison, and Harris 2010, 446) that consists of a multiple-choice component made up of 83 items 2 two writing tasks. Badcock, Pattison, and Harris (2010)

reported disciplinary differences among the generic skills scores of the students. In particular, they found that students enrolled in engineering degrees scored significantly lower on critical thinking, interpersonal understandings and written communication compared to the other two groups. They therefore suggested that research into discipline-specific teaching, learning and assessment methods would be worthwhile. This is echoed by Gimenez (2012), who conducted a two-year study on the academic writing of students from the disciplines of nursing and midwifery and found that even in these similar disciplines, the disciplinary context was found to have an effect over the shaping of students' academic writing during their undergraduate years.

While these previous studies have found that disciplinary contexts and cultures do have an impact on students' generic skills development, the present study aims to explore what disciplinary differences mean for the design of a generic skills curriculum. This is achieved through an analysis of questionnaires completed by first-year engineering and business students in Hong Kong which aims to address the following questions:

- From the students' perspectives, whether and what generic skills are important in their disciplines?
- What is their competency level in each of these competencies?
- Do they want to develop generic skills? Why and why not?
- What do they think are the appropriate ways to develop generic skills?
- How should these generic skills really be developed in order to be transferable in different situations?

Methodology

Each university in Hong Kong has its own policy and curriculum that promotes generic skills and whole-person development. The original sample of first-year university students consisted of 663 undergraduate students who enrolled in the introductory courses of the Faculty of Engineering and the Faculty of Business and Economics at a research-intensive university in Hong Kong, where English is used as a medium of instruction. As reflected in the educational aims of the university, graduates of the undergraduate curricula are expected to have acquired the following attributes (The University of Hong Kong 2017):

1. the capability to pursue academic and professional excellence, critical intellectual enquiry and life-long learning;
2. the ability to tackle novel situations and ill-defined problems;
3. the ability for critical self-reflection, greater understanding of others, and upholding personal and professional ethics;
4. a capacity for intercultural understanding and global citizenship;
5. competence in communication and collaboration and
6. a capacity for leadership and advocacy for the improvement of the human condition.

These educational aims, which can be interpreted broadly as the objectives to develop students' critical thinking skills, problem-solving skills, intercultural understanding, communication, teamwork, collaboration and leadership skills, are expected to inform the Institutional Learning Outcomes (ILOs), Programme Learning Outcomes (PLOs) and Course Learning Outcomes (CLOs) of the different faculties. While faculties are responsible for developing PLOs to align with the educational aims, course coordinators are charged with developing CLOs to align with the PLOs, reviewing and aligning teaching and learning activities and assessment processes with the CLOs, and ensuring that students understand that alignment.

At the faculty level, these generic skills are embedded within the teaching of disciplinary content. For instance, in the Bachelor of Engineering's CLOs, the attribute "the ability to tackle novel situations and ill-defined problems" has been incorporated as an ability "to design a system, component, or process to meet desired needs within realistic constraints, such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability", and "to identify, formulate and solve engineering problems" (Faculty of Engineering 2012). The attribute "a competence in communication and collaboration" has been aligned with the CLOs of "an ability to function on multidisciplinary teams" and "an ability to communicate effectively" (Faculty of Engineering 2012). As outlined on the Faculty's website, the Faculty aims at providing all-round education to students, equipping them with skill and knowledge such as cutting-edge technology, positive and lateral thinking, excellent communication and social skills, and professional integrity. Almost all Bachelor of Engineering programmes being offered are accredited by the HKIE.

For the Faculty of Business and Economics, the university educational aim of "the capability to pursue academic and professional excellence, critical intellectual enquiry and life-long learning", for example, has been incorporated into the PLOs of the Bachelor of Business Administration (Accounting and Finance) programme as the ability to "know the fundamentals, principles and theories of accounting, business and economics which meet the requirements of professional organisations", and the ability to "use analytical tools to formulate and solve accounting and finance problems". The aim of "competence in communication and collaboration" has been contextualised as the ability "to articulate and make convincing and coherent presentations", "to write effectively" and "to use specific technical terminology" (Faculty of Business and Economics 2015). By successfully completing the examinations and obtaining relevant work experience, accounting graduates can be qualified as ACCA members.

Participants and procedures

The data of this study were collected through a paper-based questionnaire from a sample of first-year engineering and business university students. Out of the original sample of 663 students, 502 students returned the completed questionnaire, of whom 316 were male, 185 were female and 1 unspecified, age ranging from 17 to 23 years old. Purely coincidental, half of the students were from the engineering disciplines, while the other half were from the business-related disciplines. Of them, 72.9% were local students, 13.5% were from mainland China and 7.6% were international students. Of the participants, 6% did not state their origin. Most of the students (74.7%) used Cantonese as their first language. Table 1 below outlines this demographic information about the student participants.

Table 1. Demographic information of student participants

	Engineering	Business
Gender	*n* = 251	*n* = 251
Male	77.7%	48.2%
Female	22.3%	51.4%

	Engineering	Business
Unspecified	0%	0.4%
Origin	$n = 251$	$n = 251$
Local	76.1%	69.7%
Mainland	9.6%	17.5%
International	8.8%	6.4%
Unspecified	5.5%	6.4%
First language	$n = 251$	$n = 251$
Cantonese	76.9%	72.5%
Putonghua	11.6%	20.3%
English	3.2%	2.8%
Other languages	8.3%	4.4%

All first-year engineering students entered the programme on common entry, and thus have not decided on their major, whereas first-year business students have already selected a specific programme of study (i.e. Accounting and Finance, Economics and Finance, International Business and Global Management) before admission. Table 2 below shows the programmes of study of the business student participants.

Table 2. Programmes of study of business student participants.

	Frequency	Per cent
Bachelor of Business Administration (BBA)	9	3.6
BBA (Account & Finance)	110	43.8
BBA (International Business and Global Management)	12	4.8
Bachelor of Economics	4	1.6
Bachelor of Economics and Finance	115	45.8
Bachelor of Engineering (Computer Science) & BBA	1	0.4
Total	251	100.0

Students were approached either outside the classrooms or during lectures, and each questionnaire took approximately 15–20 minutes to complete.

Instrument

Based on the PLOs and CLOs of the Faculty of Engineering and Faculty of Business and Economics, existing questionnaires used in literature and discussion with faculty staff members, Chan, Zhao, and Luk (2017) previously developed and validated an engineering transferable skills questionnaire, which was used in this study. The questionnaire consisted of 91 items, presented in 3 sections. In the first section, students were required to provide personal information such as gender, age, year of study, origin and their native language. The second section included students' self-assessment of 38 transferable skills under two measures, namely, their perceived level of importance (LI) of the transferable skills to their future career and their perceived current competency level (CL[AQ6]) ~~of competency~~ in these skills. The two measures required students to rate on a 5-point Likert scale ranging from 1 (very unimportant) to 5 (very important) and from 1 (very poor) to 5 (very good), respectively. A copy of the engineering questionnaire is at Appendix A.

Based on results from principal component analysis and confirmatory factor analysis conducted by Chan, Zhao, and Luk (2017), the 38 items were assigned to eight scales across both the measure of perceived importance and perceived competency, representing eight categories of transferable skills, namely, academic and problem-solving skills (8 items), interpersonal skills (8 items), community and citizenship knowledge (3 items), leadership skills (3 items), professional effectiveness (5 items), information and communication literacy (4 items), critical thinking (3 items) and self-management (4 items).

The engineering transferable skills questionnaire was modified for the business students by removing one item – 'Design a system, component or process' and by revising five items to suit the context of business education. This results in 32 transferable skills common to both the engineering and business disciplines. For example, an item was changed from 'Design and conduct experiments' to 'Design and conduct business, economic and/or financial modeling' and another item was changed from 'Use engineering equipment' to 'Use business, accounting and/or economics-related software'. The amendments were made based on comments collected on item clarity and relevance during consultation sessions with business teachers and experts in business education. The final version of the transferable skills questionnaire for business students consisted of 89 items, and similar to that of the engineering questionnaire, was presented in three sections.

The last section consisted of five items asking students to indicate their attitude towards the development and assessment of transferable skills on a 5-point Likert scale, ranging from '1' (strongly disagree) to '5' (strongly agree). Two open-ended questions were also added for students to report on their motivation to develop or not develop transferable skills and to suggest how these skills should be taught. A copy of the business questionnaire is at Appendix B.

Data analysis

This study adopted the mixed-methods approach in data collection and analysis. With the quantitative and qualitative findings complementing each other, it provided a more comprehensive picture of students' perception on generic skills and allowed meaningful interpretation of the data (Teddlie and Tashakkori 2003). The quantitative data of this study were analysed using SPSS. In particular, independent-sample *t*-tests were conducted to compare business and engineering students' perceptions of the 32 transferable skills in the questionnaire. Content analysis was undertaken to code the student participants' responses to the open-ended question on the reason they provided for wanting or not wanting to develop transferable skills.

Results

Perceived importance of generic skills

Table 3 below reports the results of the independent-sample *t*-test for comparing the perceived LI of generic skills between business and engineering students, including the number of responses, mean and standard deviation for the participants' ratings.

Table 3. Independent-sample *t*-test results for comparing ~~levels of importance~~LIs of generic skills to future careers between business and engineering students.

Level of importance to future career	Business			Engineering			*t*	*df*	*p*-value	Effect size (*d*)
	n	*M*	*SD*	*n*	*M*	*SD*				
Generate new ideas	251	4.34	.80	250	4.21	.85	1.77	499	.078	0.16
Think critically	251	4.42	.79	251	4.27	.83	2.04*	500	.042	0.19
Organize things effectively	250	4.44	.80	250	4.25	.81	2.67**	498	.008	0.24
Self-reflection	249	4.02	.82	251	3.85	.93	2.13*	498	.034	0.19
Manage time and meet deadlines	250	4.56	.78	250	4.26	.86	4.09***	498	.000	0.37
Be punctual to class or meetings	251	4.27	.86	251	4.02	.86	3.28**	500	.001	0.29
Be flexible	251	4.18	.81	251	3.97	.86	2.83**	500	.005	0.25
Be open minded	249	4.24	.75	250	4.18	.81	0.813	497	.416	0.08
Think and act independently	251	4.24	.81	250	4.07	.85	2.24*	499	.025	0.20
Offer support and ideas to others	250	4.08	.80	250	3.95	.82	1.71	498	.088	0.16
Negotiate to reach a decision	250	4.32	.83	249	4.06	.89	3.28	497	.001	0.30
Work together and listen to others' opinions	251	4.43	.73	250	4.28	.82	2.17*	499	.031	0.19
Handle conflicts	251	4.27	.77	250	4.01	.88	3.45**	499	.001	0.31
Persuade others	251	4.13	.81	251	3.82	.90	4.12***	500	.000	0.36
Build and maintain working relationship	250	4.36	.79	251	4.14	.82	3.12**	499	.002	0.27
Possess IT skills	251	3.78	.84	251	3.96	.87	−2.34*	500	.019	−0.21
Research information	250	3.98	.84	250	3.95	.81	0.44	498	.664	0.04
Identify relevant information	251	4.18	.80	251	3.98	.83	2.68**	500	.008	0.25
Express and receive ideas clearly	251	4.34	.82	250	4.16	.77	2.47*	499	.014	0.23
Write concisely	251	4.22	.90	249	3.80	.88	5.23***	498	.000	0.47
Understand your roles and responsibilities	249	4.19	.87	251	4.11	.78	1.51	498	.250	0.10
Be aware of political issues	250	3.75	.94	251	3.33	1.04	4.76***	499	.000	0.42
Be aware of social issues	251	3.99	.93	251	3.68	.93	3.75***	500	.000	0.33
Be aware of economic and environmental issues	251	4.20	.79	251	3.75	.83	6.29***	500	.000	0.56
Make judgment based on relevant information	251	4.27	.75	250	4.00	.72	4.11***	499	.000	0.37
Understand professional and ethical responsibility	250	4.12	.85	251	3.98	.81	1.84	499	.067	0.17
Understand and respect other professionals	249	4.11	.85	250	4.14	.83	−0.37	497	.714	−0.04
Motivate and supervise others	251	4.02	.80	251	3.88	.79	1.91	500	.057	0.18
Coordinate and plan tasks	251	4.17	.78	251	4.10	.79	0.97	500	.335	0.09

Level of importance to future career	Business			Engineering			t	df	p-value	Effect size (d)
	n	M	SD	n	M	SD				
Build team cohesion	250	4.28	.79	250	4.08	.79	2.83**	498	.005	0.25
Work with teammates from different background	251	4.33	.76	251	4.11	.82	3.10**	500	.002	0.28
Pursue additional knowledge beyond school-related teaching	250	4.19	.80	251	4.11	.79	1.14	499	.254	0.10

***$p < .001$; **$p < .01$; *$p < .05$.

The means of perceived importance ranged from 3.33 to 4.56, with most of the competencies rated greater than 4 in the two disciplines. This suggests that students from both disciplines generally believed that most of the generic skills were important for their future career. As compared to the other competencies, four competencies, namely, 'possess IT skills', 'research information', 'be aware of political issues' and 'be aware of social issues', were perceived as the least important by students in both disciplines, with mean values ranging between 3.33 and 3.99.

Using $p < .05$ as a cut-off for determining statistical significance, significant differences were found in 21 items in the LI to future career. Business students gave significantly higher importance ratings than engineering students on 20 generic skills items. For example, business students attributed a higher level of importance to 'be aware of economic and environmental issues' ($M = 4.20$, $SD = .79$ vs. $M = 3.75$, $SD = .83$, $t(500) = 6.29$, $p < .001$), 'manage time and meet deadlines' ($M = 4.56$, $SD = .78$ vs. $M = 4.26$, $SD = .86$, $t(498) = 4.09$, $p < .000$) and 'make judgement based on relevant information' ($M = 4.27$, $SD = .75$ vs. $M = 4.00$, $SD = .72$, $t(499) = 4.11$, $p < .000$). This finding can be explained by the fact that business students have already chosen a specific programme of study upon entry into the university. Their higher awareness of the relevance of generic skills to their career might be a result of their research undertaken on the discipline prior to commencing their university study.

Although business students scored higher than engineering students on four items, including 'think critically', 'self-reflection', 'think and act independently' and 'work together and listen to others' opinions', the difference was not significant as the calculated effect size was small ($d \leq .20$). On the other hand, engineering students gave a significantly higher importance rating ($M = 3.96$, $SD = .87$) to only one generic skills item (i.e. possess IT skills) compared to business students ($M = 3.78$, $SD = .84$, $t(500) = -2.34$, $p < .05$). This suggests that IT skills are possibly more important to the engineering discipline as they are an essential part of the discipline's academic knowledge that goes beyond information and computer literacy. Whether IT skills are important to the business students may also depend on their majors.

Compared to the findings on the 32 generic skills, a similar finding was observed for the five items that needed to be modified to suit the disciplinary context (see Table 4 below). The mean values of the perceived importance of these five items ranged between 4.0 and 4.39 for business students and between 3.94 and 4.35 for engineering students. This finding, again, indicates that business students seemed to be more aware of the relevance of generic skills to their future career. Among the five items, both business and engineering students perceived the ability to 'identify and solve problems' as the most important.

Table 4. Mean and standard deviation of the five items which have been modified for the ~~B~~business ~~D~~discipline~~.~~

Business					Engineering				
Item		n	M	SD	Item		n	M	SD
Design & conduct business, economic and/or financial modeling	LI	250	4.0	.80	Design & conduct experiment	LI	251	3.94	.87
	CL	249	2.95	.80		CL	249	3.18	.81
Analyze & interpret data from case studies	LI	248	4.08	.84	Analyze and interpret data from experiments	LI	249	4.14	.77
	CL	248	3.15	.76		CL	250	3.30	.73
Identify and solve problems	LI	248	4.39	.80	Identify and solve engineering problems	LI	249	4.35	.79
	CL	248	3.42	.76		CL	251	3.29	.72
Apply knowledge of business, accounting and/or economics principles	LI	250	4.19	.83	Apply knowledge of mathematics, science and engineering	LI	250	4.34	.80
	CL	248	3.31	.74		CL	251	3.57	.70
Use business, accounting and/or economics-related software (e.g. SAGEONE)	LI	250	4.0	.82	Use engineering equipment	LI	251	4.11	.89
	CL	249	2.48	.90		CL	250	3.10	.82

Perceived level of competency in generic skills

Table 5 reports on the results of the independent-sample *t*-test for comparing the perceived ~~C~~current ~~L of competency~~CLs ~~o~~in the 32 generic skills common to both the engineering and business disciplines.

Table 5. Independent-sample *t*-test results for comparing current CLs ~~of competency~~ in generic skills between business and engineering students~~.~~

Current level of competency	Business			Engineering			*t*	*df*	*p*-value	Effect size (*d*)
	n	*M*	*SD*	*n*	*M*	*SD*				
Generate new ideas	249	3.15	.66	248	3.23	.63	−1.33	495	0.186	−.12
Think critically	249	3.42	.66	250	3.43	.69	−.24	497	0.812	−.01
Organize things effectively	248	3.42	.74	251	3.36	.71	.94	497	0.350	.08
Self-reflection	246	3.41	.74	247	3.39	.72	.21	491	0.835	.03
Manage time and meet deadlines	249	3.42	.85	249	3.41	.90	.15	496	0.878	.01
Be punctual to class or meetings	248	3.67	.95	250	3.76	.85	−1.12	496	0.262	−.10
Be flexible	248	3.50	.71	249	3.50	.67	−.03	495	0.974	.00
Be open minded	248	3.65	.76	251	3.59	.75	.88	497	0.379	.08
Think and act independently	250	3.52	.79	250	3.52	.75	0.00	498	1.00	.00
Offer support and ideas to others	250	3.48	.73	248	3.44	.70	.63	496	0.529	.06
Negotiate to reach a decision	250	3.45	.71	251	3.39	.76	.88	499	0.381	.08
Work together and listen to others' opinions	249	3.72	.75	251	3.62	.73	1.53	498	0.127	.14
Handle conflicts	250	3.25	.73	251	3.24	.76	.14	499	0.893	.01
Persuade others	248	3.28	.76	249	3.13	.77	2.18*	495	0.030	.20
Build and maintain working relationship	248	3.46	.74	249	3.45	.72	.21	495	0.832	.01
Possess IT skills	248	2.69	.96	249	3.06	.95	−4.29***	495	0.000	−.39
Research information	245	3.17	.75	248	3.32	.71	−2.36*	491	0.019	−.21
Identify relevant information	247	3.34	.73	248	3.37	.71	−.54	493	0.589	−.04
Express and receive ideas clearly	248	3.42	.76	251	3.36	.79	.93	497	0.354	.08
Write concisely	248	3.23	.86	248	3.14	.84	1.21	494	0.226	.11
Understand your roles and responsibilities	247	3.62	.75	250	3.56	.73	.84	495	0.403	.08
Be aware of political issues	249	3.01	.89	251	3.03	.92	−.29	498	0.769	−.02
Be aware of social issues	249	3.31	.83	251	3.21	.83	1.32	498	0.188	.12
Be aware of economic and environmental issues	249	3.25	.74	251	3.22	.81	.49	498	0.624	.04
Make judgment based on relevant information	249	3.43	.69	250	3.42	.66	.16	497	0.873	.01
Understand professional and ethical responsibility	246	3.41	.77	251	3.45	.72	−.53	495	0.595	−.05
Understand and respect other professionals	248	3.67	.78	251	3.67	.80	.057	497	0.954	.00
Motivate and supervise others	249	3.21	.71	251	3.27	.78	−.81	498	0.419	−.08
Coordinate and plan tasks	249	3.35	.74	251	3.38	.75	−.50	498	0.618	−.04
Build team cohesion	249	3.35	.72	251	3.38	.78	−.55	498	0.582	−.04
Work with teammates from different background	249	3.48	.78	250	3.42	.77	.95	497	0.343	.08
Pursue additional knowledge beyond school-related teaching	249	3.29	.78	249	3.35	.70	−.91	496	0.365	−.08

***$p < .001$; **$p < .01$; *$p < .05$.

Mean values ranging between 2.69 and 3.76 were observed in students' ratings, with most skills rated greater than 3, suggesting that students in both disciplines did not find themselves as very confident in their generic skills. Students from both disciplines seemed to see themselves being weakest in 'possess IT skills' and 'be aware of political issues', as indicated by the mean values ranging between 2.69 and 3.06.

Results from the independent-sample *t*-test showed that no significant differences were found between engineering and business students' self-ratings of competency level in 29 generic skills items (see Table 5 below). Significant differences were only found in three items, namely, 'persuade others', 'possess IT skills' and 'research information'. As indicated by a medium effect size ($d = .39$), the difference was however substantial only for 'possess IT skills' in that engineering students ($M = 3.06$, $SD = .95$) rated themselves as more competent as compared to business students ($M = 2.69$, $SD = .96$, $t(495) = -4.29$, $p < .001$). According to Roach, McGaughey, and Downey (2012), students were more likely to choose a major which they saw a good match between their own skills/abilities and the skill requirements of the profession. A related finding is that of Matusovich, Streveler, and Miller (2010) who found that some engineering students decided to pursue an engineering degree because they saw themselves as a person with the characteristics of an engineer (e.g. a problem solver). In the present study, engineering students might have chosen engineering as a result of their perceived competency in science/technology-related capabilities (i.e. self-fulfilling prophecy).

Students in both disciplines generally rated their ~~CL~~current ~~of~~ competency level lower than their perceived importance of the generic skills to their future career. As Table 4 above demonstrates, the mean values of the perceived importance are also higher than that of the perceived level of competency for the five revised items. This finding suggests that in the students' opinions, there was room for improvement in their generic skills.

An analysis was also conducted for the last section of the questionnaire which contained five questions on students' attitude towards generic skills and two open-ended questions about their motivation towards them.

Students' attitude towards generic skills

As shown in Table 6, the number of business students (n = 103) who agreed that generic skills were more important than technical academic knowledge (ATTS2) is almost twice the number of engineering students (n = 66). This aligns with the previous result that business students gave significantly higher importance ratings than engineering students on 20 generic skills items and seem to be more aware of the relevance of generic skills in relation to their chosen discipline. These disciplinary differences can be attributed to the fact that while the business curriculum is probably designed to be more industry-ready, the theoretical and technical academic contents of the engineering curriculum are indisputably vast and competencies building has not been the focus.

Table 6. Business and engineering students' attitude towards generic skills.

Attitude towards transferable skills	Business				Engineering			
	n	Agree (%)	Neutral (%)	Disagree (%)	*n*	Agree (%)	Neutral (%)	Disagree (%)
ATTS1	244	16.8	16.8	66.4	240	20.0	25.8	54.2
ATTS2	243	42.4	46.9	10.7	239	27.6	51.5	20.9
ATTS3	243	53.5	36.6	9.9	239	53.1	38.1	8.8
ATTS4	243	35.0	43.2	21.8	239	38.1	39.7	22.2
ATTS5	243	34.2	45.7	20.2	238	33.6	44.1	22.3

ATTS1: Learning transferable skills is irrelevant and is an obstacle to future career; ATTS2: Transferable skills are more important than technical academic knowledge; ATTS3: Transferable skills are better developed through extra-curricular activities; ATTS4: We should be assessed and given credits for developing transferable skill; ATTS5: We should receive certificate for developing transferable skills.

In terms of students' attitude towards generic skills development and assessment, it was found that regardless of their disciplines, the majority of the students believed that generic skills were relevant to future career (ATTS1) and better developed through extra-curricular activities (ATTS3). When it comes to assessment and certification for generic skills (ATTS4 and ATTS5), students from both disciplines seemed to hold rather diverse views. While the majority remained neutral, around 33–38% agreed that their generic skills should be assessed and that they should receive certification for their development. Around 20% of students from both disciplines disagreed.

Students' motivation towards generic skills

Based on the expectancy value model of motivation (Eccles et al. 1983; Pintrich 1989), the quantitative findings suggest that the students, regardless of disciplines, are likely to be motivated to develop generic skills if they perceive these competencies as important. To further examine students' motivation for developing generic skills, content analysis was conducted on students' responses to the open-ended item (ATTS6) on the reason they provided for wanting or not wanting to develop generic skills. Responses which indicated more than one reason were coded more than once, resulting in a total of 243 responses.

As indicated in Table 7, out of the 243 open-ended responses collected, 206 responses indicated reasons for being motivated to develop generic skills, with 74.3% of them related to extrinsic motivation and 16.5% of them related to intrinsic motivation. Some extent of disciplinary differences in student motivation for developing generic skills was also observed.

Table 7. Results of content analysis of engineering and business students' open-ended responses.

Categories	Themes	Engineering			Business		
		Sample responses	Count	%of responses	Sample responses	Count	%of responses

Categories	Themes	Engineering			Business		
		Sample responses	Count	% of responses	Sample responses	Count	% of responses
Extrinsic motivation to learn transferable skills	Academic/learning-related	Yes, I want to learn. because, transferable skills are the foundation for building solid technical knowledge.It is necessary for applying the knowledge we know	11	9.09%	They can improve our learning ability.This can reinforce the knowledge learnt	7	5.74%
	Career-related	I would want to learn transferable skills because I think that is a very important part of a professional life.Because I don't want to be an engineer for the rest of my life. I want to gain skills that can be applied to other tracks & professions	30	24.79%	Beneficial to my future careerTo survive in the business world	39	31.97%
	Flexibility & adaptability	They are very useful for different jobs and professions and give you a greater variety of options.Because I don't want to be an engineer for the rest of my life. I want to gain skills that can be applied to other tracks & professions	14	11.57%	To adapt to society and working environmentSo that I can have more choices & be more versatile	6	4.92%
	General usefulness	It's practical.Want to learn since it seems to be important when dealing with actual situation	7	5.79%	I want to learn them as they might be useful in the futureI want to learn because it is an important asset that can come more practical and useful than limited and narrow knowledge on particular academic subjects	13	10.66%

Categories	Themes	Engineering			Business		
		Sample responses	Count	%of responses	Sample responses	Count	%of responses
Intrinsic motivation to learn transferable skills	Others-related (Relationship & Communication with Others)	Want to learn: Engineers also have to be in a team to work, therefore those skills are required for teamwork.I want to learn for the following reasons. 1. They make our life easier; 2. make our spare time more colourful; 3. bring good friends	12	9.92%	Life or career are not merely about the profession you work in, such as accounting, but also about the interaction with people and other activities that require skills outside of your professionI eagerly want to learn transferable skills. Firstly, those skills can not only help us perform more effectively in our careers, but also they can help us form meaningful relationship with our workmates, bosses and those around us, which can make our lives more enjoyable and less stressful	7	5.74%
	Problem-solving		0	0.00%	It could facilitate my personal development and help me enhance problem-solving skills	1	0.82%
	Relevance in society	To broaden my opportunities in contributing to the development of my country and the world of science.Want to learn: an essential skill to work in the society	6	4.96%		0	0.00%
	Personal development/Personal Relevance	One should learn transferable skills as it builds up a good personality, and one is able to communicate with others well.Want to: These skills can be used not only in work and my profession, but also in real life. They also help me grow as a whole person	18	14.88%	To become an all-rounded person.Transferable skills are essential in self-development. Because it is more important to know how to learn instead of what to learn	14	11.48%
	Interest	I want to learn because of interest.Interest	2	1.65%		0	0.00%

Categories	Themes	Engineering			Business		
		Sample responses	Count	% of responses	Sample responses	Count	% of responses
Other reasons for learning transferable skills	Other reasons	Acquire more skillsFor wanting to learn, I think these skills provide a good background and also a break	7	5.79%	Want to learn: (there is) a lot of undergraduates of BBA programs, so it is important to develop other skills to make yourself outstanding from othersSo-called transferable skill, which means it is crucial for us, is a bridge between society and campus. In my opinion, we ought to learn a bit of transferable skills	12	9.84%
Reason(s) for a lack of motivation to learn transferable skills	Difficulty	They are important for an engineering career while being intangible and difficult to develop and measure.No confidence in this area	6	4.96%	Not want to learn: difficult to learn it through lessons but should learn from experience.Not want to learn: hard	2	1.64%
	Time constraint	Time is needed to learn specific engineering courses.They spend a lot of time and usually are subjective with no model answer	5	4.13%	Overloaded curriculum already; can be abstract despite being usefulNot enough time	4	3.28%
	Workload	Not want to learn: impose a heavier burden on students.Not to learn: Workload is already too much	2	1.65%	Academic pressureHigh workload	2	1.64%
	Other reasons (not want to learn)		0	0.00%	Do not want to learn. It's not a kind of skill that can be taught I think.Not a main trend	4	3.28%
Neutral responses	Neutral	(Depending on whether I am) interested or not in that transferable skill	1	0.83%	It should be taught in daily life not specific courses.Something that cannot be acquired through constant practices, unlike studying	11	9.02%
Total number of responses			121			122	

Compared to the open-ended responses from engineering students, a higher percentage of the responses from business students was career-oriented (engineering: 24.8%; business: 32%) and pointed towards the perceived general usefulness of generic skills (engineering: 5.8%; business: 10.7%), driven by a more extrinsic motivation. This appears to coincide with the quantitative finding that business students might be more conscious about the importance of generic skills for their career and help explain why significantly more business students than engineering students perceived generic skills as more important than technical academic knowledge.

In the study, only engineering students mentioned the benefits of generic skills to the society as a reason for developing them, relatively of an intrinsic motivation in nature:

> To broaden my opportunities in contributing to the development of my country and the world of science. (Engineering Student B)

Extrinsic motivation to develop generic skills was illustrated by the majority of the open-ended responses from both

engineering and business students. In their responses, students from both disciplines also indicated their intrinsic motivation surrounding the idea of developing generic skills as part of whole-person development (engineering: 14.9%; business: 11.5%):

> These skills can be used not only in work and my profession, but also in real life. They also help me grow as a whole person. (Engineering Student C)

> It could facilitate my personal development and help me enhance problem-solving skills. (Business Student A)

A total of 25 open-ended student responses (i.e. 13 responses from engineering students and 12 responses from business students) indicated that they were not motivated to develop generic skills, while 12 out of the 243 responses were neutral. In general, regardless of disciplines, reasons given by these students for not being motivated to develop generic skills were related to the perceived amount of time required to develop these competencies and the existing workload from their academic work:

> Overloaded curriculum already; can be abstract despite being useful. (Business Student B)

> They spend a lot of time and usually are subjective with no model answer. (Engineering Student E)

As illustrated by the comment from an engineering student below, perceived difficulty in skills development and evaluation was another reason why students were not motivated to develop generic skills (engineering: 5%; business: 1.6%). This finding is also reflected in the quantitative findings that some students felt negatively about being assessed for generic skills development.

> They are important for an engineering career while being intangible and difficult to develop and measure. (Engineering Student D)

Discussion

It is evident from the present study that both first-year engineering and business students were aware of the importance of generic skills for their future careers while some disciplinary differences have been found. As compared to engineering students, business students scored higher on the importance of self-management skills (e.g. time management and punctuality), interpersonal and communication skills (e.g. conflict management, writing skills, express oneself clearly, work together and listen to others, build and maintain working relationships, and build team cohesion) and community and citizenship knowledge (e.g. awareness of economic and environmental issues). Business students also scored higher on the importance of 'work with teammates from different background', 'understand professional and ethical responsibility' and 'make judgment based on relevant information'. Most generic skills AACSB, EFMD and ACCA expect graduates to have developed were considered as important by the business students, except "information technology" (AACSB 2016, 32–33), which received an average rating (M = 3.78, SD = .84). Despite the engineering students' high ratings on the importance of teamwork, oral communication, critical thinking, problem-solving and self-management which are the accreditation criteria of ABET, HKIE and the CEF Project, "understand professional and ethical responsibility" and 'write concisely', which are also the specified learning outcomes of these accreditation bodies, received an average rating. This finding can be attributed to the fact that the first-year business students would have spent more time to research on their specific programme of study before admission which would have given them a stronger sense of identity as a potential member of the industry (Jackson 2016).

Even though engineering students did not consider IT skills as very important when compared to other competencies (e.g. time management and critical thinking), they saw themselves as more competent in IT skills when compared to business students. In comparison to their self-rating of other competencies (e.g. punctuality, working together with others, understanding and respect other professionals), engineering students' rating of their IT skills competency is, however, relatively weak. As Chan, Zhao, and Luk (2017) noted in their study, first-year engineering students understood the item 'possess IT skills' in the survey as 'academic and problem-solving skills', while some understood it as 'information and communication literacy'. For engineering students, information technology skills are an essential part of their academic skills that go beyond the ability to use Microsoft Office or web publishing. They include skills such as programming and building hardware and software, and thus, the item 'possess IT skills' was more relevant within the 'academic and problem-solving skills' factor[AQ7] (Chan, Zhao, and Luk 2017). In the business discipline, IT skills are far less technical and usually involve being able to use software and programs to undertake business-related work. For instance, the IT skills required of accountants nowadays include the ability to use mobile devices, data analysis tools and cloud applications such as Oracle (Drew 2012). These disciplinary differences in how IT skills are perceived indicate that some competencies might be seen as more relevant to one discipline than to another. Complementing the findings of previous studies which have demonstrated that generic skills can only be conceptualised and developed within disciplinary contexts (e.g. Jones 2007, 2009a, 2009b; Badcock, Pattison, and Harris 2010; Sweetman, Hovdhaugen, and Karlsen 2014; Bunney, Sharplin, and Howitt 2015), the findings of the present study also point to the need to identify and conceptualise generic skills within particular disciplinary contexts.

Apart from the generic skills that may vary across disciplines, each discipline also has its preferred teaching pedagogy deemed to be most suited for the transmission of both technical content and generic skills development. In engineering, project-based learning is often adopted to involve students in projects based on real-life scenarios to solve challenging technical problems (Ballantine and Larres 2004). Through working in teams, students not only can acquire knowledge in the field but also develop different skills including problem-solving, teamwork and creativity. Similarly in the business discipline, since its introduction by the Harvard Business School in the 1920s, case study method has been widely used in business-related areas such as accounting and management (Ballantine and Larres 2004). By building links between the theoretical and practical aspects of the subject matter, case study method allows business students to acquire the knowledge, skills (e.g. teamwork, negotiation and presentation skills) and tools to tackle the types of authentic, real-life problems they will encounter in their future careers (Boyce et al. 2001). The teaching pedagogies and curriculum adopted by the engineering and business disciplines are bounded by the traditional laboratory and classroom settings which mean that they cannot be easily adapted from one discipline into the other.

While one size does not fit all disciplines, the present study has pointed to the importance of interdisciplinary teaching and learning for generic skills development. Previous research on interdisciplinarity has found that students, as a result of learning from other disciplines through interdisciplinary programmes, have a higher level of critical thinking and creativity, as well as broadened horizons and the ability to integrate conflicting viewpoints and multiple perspectives in solving issues (Newell 1990; Repko 2008). To develop students' critical thinking skills, Toynton (2005, 110) believed that students needed to be exposed to more than one discipline in order for them to view the subject matters "from a detached and comparative viewpoint" which could enrich their learning and broaden their horizons.

While the teaching pedagogies of the engineering and business disciplines pose restrictions on implementing interdisciplinary teaching within the traditional classroom, to enhance student learning experience and outcomes, teachers need to provide

opportunities for students to develop generic skills in an interdisciplinary learning environment where students from different disciplines can help realise each other's own strengths and weaknesses. This will help students to look at subject matters more holistically from more than one perspective, and overcome any shortcomings from one discipline's viewpoint. As also evidenced in the present study, students are more driven by extrinsic motivation such as career to develop generic skills. However, not all students these days will work in areas related to their primary degree discipline, and academic/technical knowledge is becoming obsolete exponentially. Thus, when incorporating generic skills into the disciplinary curriculum, students should be encouraged to develop the skills in an open-minded fashion, so that they can apply them in different contexts and situations. Skills-to-learn and skills-to-transfer may therefore be the most important skill for students to develop and apply in different contexts, and interdisciplinary programmes can also help students develop this skill.

Even if generic skills are embedded within discipline and course curriculum, the learning outcomes of these skills are not distinctively specified, assessed and reported as individual learning outcomes (Drummond, Nixon, and Wiltshire 1998; Badcock, Pattison, and Harris 2010). Students therefore may not even be aware of the competencies they develop in their classes (Hughes and Barrie 2010). As Natoli, Jackling, and Seelanatha (2014) illustrated, a supportive learning environment contributed to students' generic skills development and their positive perceptions of such development. If they can be reminded of the practical applications of the specific generic skills before developing them each time, they will then be able to pay more attention to developing these competencies (Crebert et al. 2004). As this study has shown, only about 28% of first-year engineering students agreed that generic skills were more important than academic knowledge, while over 50% remained neutral. Business students who perceived generic skills as more important than academic knowledge and who were neutral about it ranged between 42% and 47%. Regardless of disciplines, students' perceived importance for all 32 generic skills was generally higher than that of the perceived level of competency in the present study. As Grier (2013) discussed, importance rating indicates an ideal level of competency which students would like to achieve. The findings therefore imply that the students had low confidence in their generic skills and thought their skills should be further improved. Course curriculum should therefore put more emphasis on generic skills as part of the learning outcomes, particularly those competencies the students perceived as less important or relevant but required by their professions, and more collaboration between disciplines should be encouraged to capitalise on the benefits of interdisciplinary teaching and learning.

Within their Holistic Competencies Development Framework (HCDF), Chan and Yeung (in press) show that student's drive or motivation, which can be classified into extrinsic and intrinsic motivation, is one of the important factors for developing generic skills. Intrinsic motivation is said to be conducive to generic skills development and can be encouraged through out-of-classroom activities (Chan and Yeung in press). In the present study, the engineering and business students demonstrated more extrinsic than intrinsic motivation to develop generic skills and, consistent with the findings of previous studies, they believed that extra-curricular activities could better develop their generic skills than the academic curriculum. In designing a curriculum that incorporates generic skills training, teachers would need to understand student's drive and motivation towards the expected competencies or activities and a way to motivate students to develop generic skills is to expose them to authentic working environment which will provide them with opportunities to realise and appreciate the relevance of these competencies for professional development (Luk et al. 2014).

The teaching pedagogies and curriculum adopted can also be bounded by the culture and mentality of teachers and academics who are not convinced that teaching generic skills is part of their duties. As a number of surveys have shown (e.g. OECD 2016), having specific skills is more important than having specific disciplinary knowledge. If we are to shift the culture of education~~culture~~, there is a need to address the imbalance between academic disciplineary knowledge and the generic skills sets taught in education.

Conclusion

This paper has investigated and compared the perceptions of generic skills of first-year engineering and business students in a university in Hong Kong. A total of 502 students consisting of 251 students from each of the disciplines rated their perceived importance of generic skills for their future careers as well as their perceived competency level in these competencies. Some significant differences have been found between the students from the engineering and business disciplines in their perceived importance of most of the generic skills, whereas the differences in the students' self-rating of competency level were not significant, except for one item (i.e. IT skills).

One limitation of the current study concerns the participant samples. Although IT skills, research skills and the awareness of political and social issues were considered as the least important for both engineering and business students, this finding is to be interpreted with care, as students in the sample were only in their first year of study at the university and thus had very limited experience and/or understanding of their disciplines and university environment to understand the importance of these skills.

Future studies can explore further the perceptions of students in engineering and business majors, and consider involving final-year students to look into possible differences in generic skills development between engineering and business students as a result of disciplinary differences in learning environment and pedagogical practice. Follow-up studies can also be conducted to investigate whether there are any changes in students' perception of the importance of different generic skills towards their final year as they would have studied in their chosen field for a much longer period. A longitudinal study which follows the same students from their first year through to their final year of study can also be carried out to determine whether their perceptions of generic skills change. To inform the design of curriculum for generic skills, future studies can also investigate further what can drive students from both the engineering and business disciplines to develop generic skills and the possibility of interdisciplinary collaboration. As this study has shown, developing students' generic skills requires the alignment of curriculum design, teaching pedagogy as well as students' attitudes and motivation. While this is difficult to achieve with the current constraints of resources and time, interdisciplinary education can be a pathway to introduce generic skills training for students.

Funding

This work was supported by the Hong Kong Research Grants Council under the General Research Fund [numbers 17610215 and 741611[AQ2][AQ3]].

Acknowledgements

Any opinions, findings and conclusions expressed in the article are those of the authors and do not necessarily reflect the

views of the sponsoring agency. The authors wish to acknowledge the faculties and students who participated in this study and are grateful to Ms Lillian Luk and Ms Veronica Lai for their assistance in the project.

Disclosure statement

No potential conflict of interest was reported by the authors[AQ8].

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Appendix A

Expectation Survey on Transferable Skills at HKU Engineering

This survey is conducted by the Centre for Enhancement of Teaching & Learning (CETL) to investigate undergraduate students' perception of transferable skills. Information collected will facilitate our research and assist the university in improving the engineering curriculum. Please note that your participation is voluntary and all information collected will be anonymous and confidential.

Appendix B

Expectation Survey on Transferable Skills at HKU Business, Economics & Finance

This survey is conducted by the Centre for Enhancement of Teaching & Learning (CETL) to investigate undergraduate students' perception of transferable skills. Information collected will facilitate our research and assist the university in improving the business, economics and/or finance curriculum. Please note that your participation is voluntary and all information collected will be anonymous and confidential.