

Student development under a new general education program in Hong Kong: A 3-year longitudinal assessment

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Abstract

Universities in Hong Kong have implemented general education programmes since September 2012 when the undergraduate education was formally extended from three years to four years. At The Hong Kong Polytechnic University (PolyU), a new general education curriculum entitled 'General University Requirements' (GUR) has been incorporated in its four-year undergraduate education, aiming to cultivate five desired graduate attributes (critical thinking, problem solving, effective communication, ethical leadership, and lifelong learning). To investigate students' actual learning and development over time under the new general education programme, a yearly online survey was conducted for three consecutive years ($N = 460$). Results showed that students gained significant improvements in their development of the five desired generic competences after two-year university study, despite a slight decrease in some of these attributes in the second year of their university life. These findings suggest that the new general education programme at PolyU is effective in promoting students' personal development and its intended learning outcomes are largely achieved.

Keywords: General education, learning outcomes assessment, education reform, longitudinal study, generic attributes

Introduction

Higher education system is undergoing changes in face of globalization and emergence of the knowledge economy. In Hong Kong, the University Grants Committee (UGC) mandated the extension of undergraduate education for one additional year (i.e., from 3-year to 4-year) in eight public universities starting from 2012/2013 academic year. The additional year allows the universities to implement their new general education (GE)

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programs, which aim to help students develop desirable generic attributes such as critical and higher-order thinking, effective communication, leadership, ethical reasoning, and lifelong learning (1), and thus promote students' all-round development. However, little is known about the actual impact of the GE reform on student learning and development. To address this question, the present study investigated how students change pertaining to five desirable generic attributes during their three-year study of one new GE program at The Hong Kong Polytechnic University (PolyU), one of the public universities in Hong Kong.

Educational changes and learning outcomes assessment

It is believed that higher education adds value to individual development (2). What university graduates have achieved from university learning has long-term effects of shaping their life and determining their career development (3). Furthermore, as contemporary economy is primarily based on knowledge and service, competitiveness of citizens is crucial to competitiveness and success of a society (4). As such, the University Grants Committee of Hong Kong (UGC) (5) believed that Hong Kong's vision to be Asia's world city 'is only possible if it is based upon the platform of a very strong education and higher education sector'. It is this profound worth of higher education that calls for investigations on how university curriculum affects students and to use this information to increase the effectiveness of higher education.

In recent years, employers and researchers criticize that what undergraduate students learned in college are falling well short of 21st Century's demands and higher education institutions may not effectively teach foundational skills that promote student success in contemporary knowledge society (6-7). These concerns prompted a great deal of research especially in North American, Europe, and Australia and the results suggest the importance of a systematic approach to embed a wide range of generic attributes beyond disciplinary expertise or knowledge across curricula in university education (8-10). In response, more and more higher education

institutions have placed a higher priority on cultivating students with more generic competences or 'soft skills', by revising teaching practice, implementing 'high-impact' educational programs or integrating General Education (GE) in university curricula. For instance, the Association of American Colleges and Universities (11) has launched a campaign to promote contemporary liberal education and proposed four learning outcomes essential for students to thrive in rapidly changing world, including 'knowledge of human cultures and the physical and natural world,' 'intellectual and practical skills,' 'personal and social responsibility,' and 'integrative and applied learning.'

With these far-reaching educational changes comes research on assessment of actual student accomplishment as a result of university study (12-14). Particular across the United States, there has been a great deal of momentum behind student learning outcomes assessment. For example, according to two national surveys conducted by the National Institute for Learning Outcomes Assessment (NILOA) (15), most higher education institutions have applied various assessment approaches such as student surveys and classroom-based assessments to perform learning outcome assessment. Besides, researchers have explored the impacts of contemporary educational practice, especially liberal education on student achievement (13, 16-18). Basically, these studies suggest that numerous teaching and learning practices (e.g., first-year seminars, reflective learning, learning communities, group project, global learning, service learning, etc.) involved in liberal education are effective to foster essential learning outcomes in college, such as critical and higher-order thinking, moral reasoning, ethical leadership, civic and social responsibility, global looking and multicultural competences.

Education reform and emphasis on general education in Hong Kong

In recent decades, Hong Kong has experienced significant economic and social-cultural changes, including the historical change from a British colony to a Special Administrative Region of

China, an increase in economic development and living standards, and the structural shift from a manufacturing-oriented economy to a knowledge- and service-based economy (19). All these factors make quality higher education particularly important for developing people with a broad knowledge base and multiple competences to sustain Hong Kong's development (20). However, the 3-year undergraduate education under the British framework in Hong Kong has long been criticized for its over-specialization and emphasis on passive learning (21). University curricula that concentrate on specialist knowledge upon student enrollment might successfully help students develop intellectual competence, yet they were inadequate to nurture other generic attributes such as critical thinking, leadership, and communication skills. Just as pointed out by Freake (1), Hong Kong university graduates were 'technically knowledgeable upon entry to the workforce, but with limited ability to develop over time and adapt to new situations'. A similar concern was indicated by a market survey which found that over 80% of Hong Kong employers were not confident that Hong Kong students developed sufficient generic attributes such as creativity, analytical thinking, leadership and interpersonal skills (22). The survey also revealed that approximately 90% of the employers thought that Hong Kong students performed worse than their North American counterparts.

As a result, education reform is in great need to address these concerns and respond to demands of today's society. To this end, Hong Kong Education Commission raised education reform proposals in 2000 and UGC mandated the formal structural change in higher education system in 2012/2013. Specifically, the eight public universities funded by UGC extended the length of their undergraduate education from three to four years and incorporated GE programs in the new curricula. It is expected that the new 4-year undergraduate curricula would contribute to the development of qualified graduates with holistic competences to form a solid foundation for Hong Kong's economy, development of society, and its place in the fast-changing world (23).

As UGC did not mandate a formal structure for GE in Hong Kong, each university independently

developed their own GE programs (1, 21). Despite divergence in some specific common core requirements of GE curricula in different universities, three features were commonly shared (21). First, a set of intended learning outcomes were emphasized to cultivate desirable graduate attitudes, which focused on multidisciplinary knowledge, multi-perspective, critical thinking, communication, problem-solving, civic responsibility, ethic reasoning, leadership, lifelong learning, and global outlook (1). Second, to align with the intended learning outcomes, traditional teacher-centered pedagogy emphasizing book learning and rote memorization was altered to a more engaging and student-centered pedagogy, such as individual project and group presentation. Third, more authentic forms of assessment were adopted accordingly to motivate student learning and support learning outcomes (21).

Basically, the GE curricula in Hong Kong are based on a US-style general education framework (21). In fact, most teaching and learning practices involved in Hong Kong GE curricula were similar to that being regarded as 'good practices' or 'high-impact educational practices' in the United States (13, 24). As mentioned earlier, these practices adopted in general education have been widely studied in the USA and vetted as positively contributing to university students' holistic development and growth (e.g., 3,13). However, whether they are also effective in Hong Kong remains unknown.

Compared with the long history of general education in the United States, Hong Kong GE program represents an entirely new curricular structure and educational philosophy. As a result, it may have 'less legitimacy as a valued education undertaking and thus will be more difficult to develop as an integral component of undergraduate education' (21). On the other hand, Hong Kong students are used to Chinese culture and learning styles, such as didactic training, thus they may have reluctance and difficulties in adapting to the more active mode of pedagogies associated with GE subjects. Just as asked by Jaffee (21): 'will the students suddenly be prepared to engage, interact, debate, participate, discuss, and criticize?' Concerning these challenges, it cannot be taken for granted that GE programs in Hong Kong are

effective as they were in the USA. As a result, there is a need to investigate the actual changes of students and provide evidence for the effectiveness of general education in Hong Kong.

Assessment of student learning outcomes under general education in Hong Kong

As GE programs in Hong Kong vary in structure in eight universities, assessment of students' learning outcomes should accordingly pertain to the specific GE curriculum. Despite the importance of effective assessment of student achievement under the new GE curricula, only a few universities have carried out evaluation projects, among which most were preliminary and focused on pilot courses of new GE curricula. For example, one institution formally evaluated a general education foundation course during its pilot stage, while did not report any evaluation findings in formal implementation (25). Another university launched a 2-year study to assess the effectiveness of pilot courses of its GE program (26), but no evaluative findings were published.

At The Hong Kong Polytechnic University (PolyU), a five-year longitudinal evaluation project involving multiple evaluation strategies to systematically investigate the effectiveness of its new GE program has been implemented since 2012/2013 academic year (27). At PolyU, the new GE curriculum entitled 'General University Requirements' (GUR) includes six core components: Freshman Seminar, Language and Communication Requirements, Leadership and Intrapersonal Development, Cluster Area Requirements, Service Learning and Healthy Lifestyle. These GUR components cover a wide range of subjects and intended learning outcomes, which are aligned with five desired graduate attributes defined by PolyU: problem solving, critical thinking, lifelong learning, ethical leadership, and effective communication (28). Despite the challenges in implementing GE in Hong Kong we mentioned before, the GUR subjects were overall well-received by both students and teaching staff (27, 29-31). Evaluation findings on one specific subject developed to satisfy the Leadership and Intrapersonal Development requirement also showed that students

were not only satisfied with the course (32, 33), but also demonstrated positive changes after taking the course (34).

While the abovementioned findings could support effective implementation of the GUR at PolyU, it is still not clear whether students had significant personal development not just in a single course. To answer this question, the current study sought to assess students' learning and development during GUR study by comparing their ratings on five desired graduate attributes of PolyU across three years. This longitudinal objective outcome evaluation would provide more convincing evidence on students' changes and personal growth over time (35).

Methods

Participants of the longitudinal study are PolyU undergraduate students under the 4-year curriculum enrolled in 2012-2013 academic year when the GUR was first implemented. Students are invited to complete an online survey every year and their informed consent are obtained before the first wave of data collection. Up to 2014-2015 academic year, three waves of data have been collected.

In the first wave of data collection, a pool including 1,000 students from eight faculties/schools at PolyU was initially selected based on a stratified random sampling method. These 1,000 students were invited through emails and/or phone calls to complete the online survey in November 2012 (i.e., 2012-2013 academic year), and 687 of them responded to the invitation while 543 completed the survey, resulting in a response rate of 54.30%. The second wave of data collection was conducted in November 2013 (i.e., 2013-2014 academic year). Those 687 students who responded to the invitation in first wave were invited again and 643 students completed the survey, resulting in a response rate of 93.59%. In the third wave of data collection conducted in November 2014 (i.e., 2014-2015 academic year), an invitation was sent to 643 students who participated in the second wave of online survey. A total of 566 students completed the online survey in the third wave, indicating a response rate of 88.02%.

In order to investigate longitudinal development of students across three years, data collected in the three waves were matched which resulted in 460 students ($M_{age} = 20.12$, $SD_{age} = .54$) who completed all three waves of online survey. Among these participants, 182 (39.57%) were male, and 278 (60.43%) were female. A total of 333 (72.39%) participants were born in Hong Kong, 113 (24.57%) were born in mainland China, and the remaining 14 (3.04%) were born in other places. Most participants reported that their parental marital status was first marriage (82.83%). Preliminary analyses showed that there were no significant differences in measures of demographic information including age, gender composition, place of birth and parental marriage status between the matched sample ($N = 460$) and those students who dropped out of the survey after the first wave of data collection ($N = 83$).

Instruments

To measure student development regarding the five desired graduate attributes defined by PolyU, three core instruments were used: a) Chinese Interpersonal Reactivity Index (C-IRI), b) Chinese Positive Youth Development Scale (CPYDS), and c) National Survey of Student Engagement (NESS) which has been updated in 2013. A total of 13 subscales of these instruments were adopted as indicators of the five desired attributes. The alignment of each subscale with corresponding attribute to be measured is shown in Table 1 and Cronbach's alpha for each subscale in each wave is shown in Table 2.

Chinese-Interpersonal Reactivity Index (C-IRI)

Since ethical reasoning and empathy are important competences of an ethical leader (36), the present study used the Empathy (EM, 11 items) subscale of the C-IRI that adapted by Siu and Shek (37) as one measure of ethical leadership. Using a 4-point Likert scale, average score across 11 items was computed as one indicator of ethical leadership. The C-IRI has been widely used and demonstrated good reliability in previous studies (e.g., 38, 39). In the present study, Cronbach's alpha coefficients of the EM subscale in three waves ranged from .68 to .72, indicating good reliability.

Chinese Positive Youth Development Scale (CPYDS)

The Chinese Positive Youth Development Scale (CPYDS) was developed by Shek, Siu, and Lee (40) to measure Chinese adolescents' positive youth development (PYD) attributes. The original scale contains 90 items related to 15 constructs of PYD, and has been found to be valid and reliable as a global measure of PYD in Chinese adolescents in previous studies (34, 41). In the present study, 6 subscales of the CPYDS including Problem Solving (PS), Social Competence (SC), Critical Thinking (CT), Ethical Leadership (EL), Self-leadership (SL), and Life-long Learning (LL) were adopted to measure student developmental qualities. Using 6-point Likert scale, average scores across items in each subscale were used to form indexes reflecting students' performance in the desired graduate attributes. In the present study, the internal consistencies of the subscales were from acceptable to good as reflected by the medium to large Cronbach's alpha coefficients across three waves.

National Survey of Student Engagement (NSSE)

Another instrument used in the present study was a locally adapted version of the NSSE which assesses student engagement in high levels of learning and development. The NSSE has been widely used at universities in many countries, including USA, Canada, Australia, and China (42-44). The NSSE consists of 47 items pertaining to 10 Engagement Indicators (EIs) (45), including Higher-Order Learning (HO), Reflective & Integrative Learning (RI), Learning Strategies (LS), Quantitative Reasoning (QR), Collaborative Learning (CL), Discussions with Diverse Others (DD), Student-Faculty Interaction (SF), Effective Teaching Practices (ET), Quality of Interactions (QI), and Supportive Environment (SE). The present study used 6 EIs (i.e., HO, RI, LS, QR, CL, and DD) to indicate student competence in lifelong learning and effective communication (see Table 1). We adopted a 4-point Likert scale for all items in 6 subscales and calculated average scores in each subscale. In the present study, the Cronbach's alpha coefficients for these subscales ranged from .62 to .88 across three waves, suggesting good internal consistencies of adapted subscales.

Table 1. Alignments between subscales and desired graduate attributes at PolyU

Desired Attributes	Instruments	Indicators
Problem Solving	CPYDS	Problem Solving
Critical Thinking	CPYDS	Critical Thinking
Lifelong Learning	CPYDS	Life-long Learning
	NSSE	Higher Order Learning
		Reflective and Integrative Learning
		Learning Strategies
		Quantitative Reasoning
Ethical Leadership	C-IRI	Empathy
	CPYDS	Ethical Leadership
Effective Communication	CPYDS	Social Competence
	NSSE	Collaborative Learning

Note. CPYDS: Chinese Positive Youth Development Scale. C-IRI: Chinese-Interpersonal Reactivity Index. NSSE: National Survey of Student Engagement.

Table 2. Reliabilities of each instrument used in three waves

Instruments	Subscales	# of Items	Reliability					
			2012-2013		2013-2014		2014-2015	
			α	Mean inter-Item Correlation	α	Mean Inter-Item Correlation	α	Mean Inter-Item Correlation
C-IRI	Empathy	11	.72	.19	.69	.17	.71	.19
CPYDS	Problem Solving	3	.67	.42	.65	.38	.76	.51
	Social Competence	3	.84	.65	.86	.68	.86	.68
	Critical Thinking	3	.68	.42	.77	.53	.83	.61
	Ethical Leadership	15	.83	.25	.89	.36	.87	.33
	Self-Leadership	5	.68	.30	.71	.33	.72	.35
	Life-Long Learning	2	.46	.30	.59	.42	.63	.47
NSSE	Higher Order Learning	4	.77	.45	.77	.46	.82	.54
	Reflective and Integrative Learning	7	.82	.40	.84	.43	.88	.51
	Learning Strategies	3	.70	.43	.75	.50	.78	.54
	Quantitative Reasoning	3	.71	.45	.70	.43	.79	.56
	Collaborative Learning	4	.70	.37	.75	.42	.76	.44
	Discussions with Diverse Others	4	.66	.33	.62	.29	.69	.36

Note. CPYDS: Chinese Positive Youth Development Scale. C-IRI: Chinese-Interpersonal Reactivity Index. NSSE: National Survey of Student Engagement.

Results

To explore student development over three years, 13 repeated measures analysis of variance (ANOVA) with Bonferroni post hoc tests were performed, each using one indicator of the five desired attributes at

PolyU as the dependent variable. The independent variable was time, operationalized as the academic year when the data were collected and extracted (i.e., 2012-2013, 2013-2014 and 2014-2015). Results of ANOVA are summarized in Table 3.

Table 3. Comparisons of students' performance in three waves (N = 460)

Desired Attributes	Indicators	2012-2013		2013-2014		2014-2015		Repeated Measures ANOVA	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i>	η^2_p
Problem Solving	Problem Solving ^a	4.28	.70	4.24	.66	4.47	.64	28.80***	.06
Critical Thinking	Critical Thinking ^b	4.65	.62	4.59	.67	4.67	.69	3.95*	.01
Lifelong Learning	Life-Long Learning	4.66	.77	4.59	.73	4.63	.74	1.83	.004
	Higher Order Learning ^{ad}	2.42	.57	2.51	.55	2.77	.57	65.46***	.13
	Reflective and Integrative Learning ^a	2.34	.48	2.28	.47	2.64	.51	120.63***	.21
	Learning Strategies ^a	2.49	.61	2.46	.58	2.60	.61	11.27***	.02
	Quantitative Reasoning ^{ad}	2.06	.57	2.16	.55	2.40	.61	56.54***	.11
Ethical Leadership	Empathy ^c	2.94	.37	2.88	.36	2.92	.36	5.63**	.01
	Ethical Leadership ^c	4.67	.45	4.57	.53	4.63	.49	10.72***	.02
	Self-Leadership ^b	3.83	.56	3.79	.56	3.86	.57	3.21*	.01
Effective Communication	Social Competence	4.59	.76	4.58	.73	4.61	.74	.31	.001
	Collaborative Learning ^a	2.43	.54	2.39	.53	2.59	.54	26.27***	.05
	Discussions with Diverse Others ^a	2.27	.54	2.24	.51	2.46	.60	34.67***	.07

Note..^a Post hoc Bonferroni test indicated that rating in Wave 3 was significantly higher than rating in both Wave 1 and Wave 2. ^b Post hoc Bonferroni test indicated that rating in Wave 3 was significantly higher than rating in Wave 2. ^c Post hoc Bonferroni test indicated that rating in Wave 2 was significantly lower than rating in Wave 1. ^d Post hoc Bonferroni test indicated that rating in Wave 2 was significantly higher than rating in Wave 1.

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

Problem solving

Students' ability in problem solving was assessed by the CPYDS Problem Solving (PS) subscale. Results of repeated measures ANOVA showed that there were significant differences in participants' scores of PS across three academic years ($F(2, 918) = 28.80$, $p < .001$, $\eta^2_p = .06$). Bonferroni post hoc tests further

revealed that the rating in 2014-2015 ($M = 4.47$, $SD = .64$) was significantly higher than the ratings in 2012-2013 ($M = 4.28$, $SD = .70$, $p < .001$) and 2013-2014 ($M = 4.24$, $SD = .66$, $p < .001$). These results suggested that participants had significant growth in their problem solving competence after two years of GUR study.

Critical thinking

Students' critical thinking was measured by the CPYDS Critical Thinking (CT) subscale. Significant differences in participants' scores of critical thinking over the span of three years were also observed ($F(2, 918) = 3.95, p = .02, \eta^2_p = .02$). Participants had higher critical thinking scores in 2014-2015 ($M = 4.67, SD = .69$) than they had in 2013-2014 ($M = 4.59, SD = .67, p = .02$). The results provided evidence for positive development in students' critical thinking from their second years to third years of university study.

Lifelong learning

Students' capacity of lifelong learning was measured by five indicators: Life-long Learning (LL) subscale of CPYDS, and four subscales of NSSE including Higher-Order Learning (HO), Reflective and Integrative Learning (RI), Learning Strategies (LS), and Quantitative Reasoning (QR). While no significant differences were observed in ratings of LL among three waves ($F(2, 918) = 1.83, p = .16, \eta^2_p = .004$), significant differences were found in ratings of HO ($F(2, 918) = 65.46, p < .001, \eta^2_p = .13$), RI ($F(2, 918) = 120.63, p < .001, \eta^2_p = .21$), LS ($F(2, 918) = 11.27, p < .001, \eta^2_p = .02$), and QR ($F(1.97, 905.99) = 56.54, p < .001, \eta^2_p = .11$). For these four indicators, post hoc tests further revealed that student scores in 2014-2015 were significantly higher than their scores in both 2012-2013 and 2013-2014. Besides, for HO and QR, scores in 2013-2014 were also significantly higher than that in 2012-2013. Means and standard deviations for the four indicators are listed in Table 3. These findings suggested that students' competence of lifelong learning has been significantly improved in the third year of their university study.

Ethical leadership

Three indicators were used to measure ethical leadership: Empathy (EM) subscale of C-IRI, the Ethical Leadership (EL) and Self-leadership (SL) subscales of CPYDS. Results of repeated measures ANOVA indicated that student scores in these three subscales had significant differences in three

academic years (see Table 3). Post hoc analyses further indicated that EM score in 2013-2014 ($M = 2.88, SD = .36$) was significantly lower than that in 2012-2013 ($M = 2.94, SD = .37, p = .002$). For EL, the score in the second year ($M = 4.57, SD = .53$) was significantly lower than that in the first year ($M = 4.67, SD = .45, p < .001$) while marginally lower than that in the third year ($M = 4.63, SD = .49, p = .05$). Moreover, student SL score in 2014-2015 ($M = 3.86, SD = .57$) was significantly higher than that in 2013-2014 ($M = 3.79, SD = .56, p = .03$). These findings suggested that students tended to give lower ratings for their empathy and ethical leadership in their second year. Nevertheless, the ratings rebounded in third year of university study.

Effective communication

Three subscales were adopted to assess students' effective communication including Social Competence (SC) subscale of CPYDS, Collaborative Learning (CL) subscale and Discussions with Diverse Others (DD) subscale of NSSE. Repeated measures ANOVA showed that there was no significant difference in students' scores on SC among three waves ($F(2, 918) = .31, p = .73$). However, students scored higher on CL ($F(1.97, 905.62) = 26.27, p < .001, \eta^2_p = .05$) and DD ($F(1.96, 900.05) = 34.67, p < .001, \eta^2_p = .07$) in 2014-2015 as compared to 2012-2013 and 2013-2014. In other words, in the third year of university study, students had more collaborative learning and were more likely to discuss with diverse others in their study.

Discussion

In Hong Kong, GE curricula usually have two sets of intended learning outcomes (46). One is 'program intended learning outcomes' which incorporate goals of all general education subjects, such as five desired graduate attributes of PolyU, and the other is 'course intended learning outcomes' which are more specific and should support 'program intended learning outcomes.' The rationale behind two-level design is that it is impossible to achieve all program-level outcomes through one single GE course (47). Such a

framework used in designing intended learning outcomes requires two-level assessment accordingly: course-level and program-level (47-48). While course-level assessment of student learning outcomes has been carried out in each GE course in all universities in Hong Kong (21), including PolyU (32-34, 49), program-level assessment showing how the students learn and develop as a result of the whole general education curriculum is scanty. In this case, the present study represents a pioneering work in conducting program-level assessment in Hong Kong to reveal how well the students achieve the intended learning outcomes on program-level. Such an attempt would benefit universities and program designers in terms of continuously improving the quality of general education curricula and the whole higher education system (47, 50).

Specifically, the present study investigated learning outcomes of students enrolled in a new general education (GE) curriculum, i.e., the General University Requirements (GUR) at Hong Kong Polytechnic University (PolyU). Based on comparisons of student self-reported ratings on indicators of five desirable generic competences across three academic years, results suggest that students showed significant improvement in most developmental indicators after two-year university study. These findings strongly support previous findings that the implementation of the GUR at PolyU was successful and effective (27, 29). Furthermore, on top of the positive findings based on subjective outcome evaluations reported in previous studies (e.g., 30, 31), students' actual development and personal growth as measured by the current objective outcome evaluation provide much stronger evidence for the accountability and value of the GUR incorporated in the 4-year undergraduate curriculum.

Regarding students' scores on indicators of the desirable graduate attributes across three years, it seems that most developmental indicators followed a U-shaped trajectory over the period. This distribution features a visible dip on the ratings during the second year of the 4-year curriculum. For example, students tended to perceive themselves as having a lower level of capacity in critical thinking, life-long learning, reflective and integrative learning, empathy, and ethical leadership in the second year (i.e., 2013-2014 academic year) than in the first year, although the

tendency was significant in only two indicators (i.e., empathy and ethical leadership). It is possible that such a trend was a result of setbacks encountered in students' first year university life, such as difficulties in adjusting to new educational demands, social environments, and life styles. This reasoning is in line with great challenges revealed in research on university transition in the first year (e.g., 51). These challenges could continue to exist in sophomore year, resulting in identity confusion, low self-evaluation due to academic stress, and other social pressures, which may cause a decline in learning outcomes among sophomores (52).

Nevertheless, ratings on developmental indicators rebounded at the third year. It might be possible that students have already well adapted to university life after two years. For example, students may have developed sufficient skills and supporting networks to deal with academic and other types of stress in the third year of university life, as suggested by students' highest scores in collaborative learning and higher order learning strategies in the academic year of 2014-2015. It is noteworthy that students had obtained significant improvement in different aspects of generic competences after two years of university study. The improved areas included problem solving, critical thinking, higher order learning, reflective and integrative learning, learning strategies, quantitative reasoning, self-leadership, collaborative learning, and discussions with diverse others, which cover all five desired graduate attributes of PolyU. Previous research has demonstrated that good practices in general education help students develop desirable generic capacities in Western cultures (e.g., 13, 53). Findings of the present study indicate that a US-style general education curriculum is also effective in facilitating student development in a holistic manner in Chinese culture.

Taken together, while the present finding suggests that the unique characters of GE program at PolyU help promote student generic competences, for example, more engaging pedagogies are more effective in facilitating student learning than teacher-centered lecturing method (e.g., 54), it should be noted that such a positive effect might be hindered during the first year of students' university life. In other words, students may have difficulties in accepting such a totally new teaching and learning

method at the very beginning of their university life. This is consistent with some scholars' concerns that interactive pedagogies might not be readily well received by Chinese students who are largely influenced by cultural traditions (21). As a result, universities and faculties need to develop more effective approaches to incorporate interactive teaching and learning strategies in GE curricula that take into account Chinese students' characteristics. For example, nurturing student critical thinking through writing assignment may be more easily accepted by Chinese students than asking them to make critical comments in front of all students in the class. Furthermore, more assessment studies should be conducted to reveal strengths and weakness of such approaches in Chinese contexts and use the results to improve the quality of teaching and learning. Besides, additional projects or programs aiming to help freshmen adapt to university life and requirements would help students benefit from general education curricula.

The present study also provides evidence for the effectiveness of using longitudinal self-reported data to assess student learning and personal development during university study. To carry out effective program-level assessment of learning outcomes, balancing efficiency, accuracy and cost in measuring student outcomes is a great challenge. Asking students to report how much they have achieved during a certain period is an inexpensive and efficient method while students may not always be able to accurately judge their own growth (55). In contrast, longitudinal assessments of objective outcomes would be more accurate in revealing student achievement during the period. In longitudinal design, objective outcomes can be measured either with actual tests (e.g., some tasks measuring critical thinking) or self-reported questionnaire. Given that the former method should require great financial and human resources (e.g., more standardized and controlled measuring environment), and students are reasonably accurate in estimating their current attributes or skills (55), combining longitudinal design and self-reported measures represents a cost-effective and relatively accurate method to examine student personal development.

Several limitations of the present study should be noted. First, the study only measured student

outcomes in three time points and used analysis of variance (ANOVA) to examine changes, which despite its merits cannot reveal systematic change rates across different waves over time (56). As a result, future research should follow up student development for a longer time period and use more powerful statistical techniques such as growth curve modeling to identify the developmental trajectory of students (56).

Second, the present study examined student development in one university in Hong Kong. Therefore, the relative advantages and disadvantages of the GUR as compared to other GE curricula in other high education institutions were unknown. Future assessments could conduct comparisons on student learning outcomes across different universities in Hong Kong and abroad (e.g., universities in mainland China).

Third, the present study is quantitative research in nature, which is not able to provide students' in-depth perceptions on their experience (i.e., qualitative data) during university study to help researchers interpret and reflect on the findings. To gain a more comprehensive understanding of student learning outcomes and to triangulate the current findings, multiple research methods including qualitative studies should be used in future assessment of student learning outcomes.

Fourth, as no control group was used in this study, it is possible that the change is simply a result of developmental maturation. While it is a logical possibility, it is noteworthy that there is no research suggesting that university students necessarily show a rise in developmental indicators in this study (e.g., 3,57).

Finally, while we interpret the present findings in terms of the beneficial effect of the GUR at PolyU, the changes may also be due to the beneficial effect of the overall four-year programme (i.e., including the effects of Major Programme). Since both the GUR and the discipline-specific program are offered at the same time, it is difficult, if not impossible, to separate their specific effects. However, two points should be noted when we interpret the findings. Primarily, evaluation of specific GUR subjects, such as leadership subjects, shows their contribution to the development of desired graduate attributes of PolyU students. Besides, as GUR subjects concentrate more

in the first two years of the 4-year undergraduate program, it is more likely that the beneficial effect is a result of students' GUR study.

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Ethical compliance

The authors have stated all possible conflicts of interest within this work. The authors have stated all sources of funding for this work. If this work involved human participants, informed consent was received from each individual. If this work involved human participants, it was conducted in accordance with the 1964 Declaration of Helsinki. If this work involved experiments with animals, it was conducted in accordance with the related institutions' research ethics guidelines.

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