



AN EMPIRICAL STUDY ON STUDENTS' PERCEPTIONS AND ACADEMIC OUTCOMES OF DISCIPLINE-BASED COURSES VERSUS INTERDISCIPLINARY COURSES

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Abstract

This research explores undergraduate students' perceptions of their learning experiences and academic outcomes in two prevalent types of first-year courses - discipline-based and interdisciplinary courses – found in many university curricula. Discipline-based courses focus on specific subject knowledge, whereas interdisciplinary courses address issues across multiple academic fields. First-year students are often required to complete several courses from different academic departments with the aim of broadening their knowledge and exposing them to various disciplines, laying down a strong intellectual foundation for their academic growth. To gain a deeper understanding of students' perceptions of the two types of courses, a large-scale quantitative survey was conducted in one academic year, gathering data on student learning experiences from 128 courses of a General Education programme, which is a common curriculum for all undergraduate students. An empirical analysis was performed on the 7,488 data collected, focusing on five learning aspects: course design, encouragement to be creative/innovative, encouragement to think critically, course difficulty, and overall learning experience. The independent t-test results suggested that students perceived discipline-based courses to provide marginally superior learning experiences in four out of the five aspects. However, these courses were also considered as significantly more difficult than interdisciplinary ones. Conversely,

statistical analysis indicated that there was no disparity in academic performance between the two types of courses. We suggest proper academic advising to rectify students' misconceptions about these courses. The results of this work provide data-driven insights for university administrators to manage the curriculum and student satisfaction better.

Key words: Student Perception, Discipline-Based Course, Interdisciplinary Course, General Education.

Introduction

General Education (GE) programme is often regarded as the core of the undergraduate curriculum for all students regardless of their academic disciplines and majors (Allen, 2006; Huber, 2002). In many universities, undergraduate students are required to complete several GE courses in their first year of study. Very often they are free to select their own GE courses in any discipline as part of their undergraduate programmes. A number of universities have named their GE curriculum differently to reflect the unique nature of the programmes in their institutes, such as "Common Core", "Liberal Studies", and "Critical Foundations in the Arts & Science" (Bowen, 2004).

Discipline-based Courses and Interdisciplinary Courses

In general, GE courses can be divided into two types. The first type is discipline-based course, first developed at Princeton (Katz, 2005). These courses are introductory survey courses required of majors, and very often, they focus on a single discipline (Howard & Zoeller, 2007; Marks, Freeman, & Leitner, 2001). Examples of discipline-based courses are "Introduction to Information Technology", "Introduction to Econo-

mics", and "Principle of Sociology". The other type of GE course is interdisciplinary course, promoted by Columbia University and the University of Chicago (Allen, 2006). An interdisciplinary course is usually organized around a topic, issue, or problem. Instructors guide students to view, learn, and solve the topic from different angles or disciplines (Argast & Maloney, 1996; Damon-Rodriguez & Effros, 2008). Examples of interdisciplinary courses are "Technology and Society", "Green Economics", and "Law, Literature and Popular Culture". Both types of GE courses have their supporters and critics (Jensen, Klenow, & Youngs, 2019; Schwartz, 2004; Shih, 2019), the university management chooses one type of GE course which is more suitable for their students and institutes (Krueger & Kumar, 2004).

Background

The principle of GE programme was embraced by all Hong Kong publicly funded universities in 2012, and each of them developed its own GE programme (Lau, Lee, Leung, Ng, & Cheng, 2013; Yu, Shek, & Zhu, 2019). At the City University of Hong Kong, the GE programme was named as Gateway Education programme with an aim to "expose students to cutting-edge

knowledge and ideas that cross-multiple disciplines”. It promoted interdisciplinary knowledge through collaborative learning and self-discovery with the support of technologies. As a result, more than a hundred interdisciplinary courses were developed and various education technologies were adopted in different courses to support active learning, such as cloud-based tools, 3D printing technology, virtual reality technology, and throwable microphone (Chiu, Lai, Fan, & Cheng, 2015; Chiu, Wong, & Im, 2018; Chiu & Li, 2015; Im, Chiu, Shek, Ng, & Li, 2019). The university has also established an active learning classroom to support student creativity and innovation and to enhance student in-class engagement (Chiu, 2016; Chiu & Cheng, 2017; Chiu, Im, & Shek, 2022). Student feedback on the GE programme was positive. However, as the GE programme operated for a few years, some instructors and academic staff started questioning the effectiveness of the existing interdisciplinary courses in student learning and academic performance. As a result, the university management requested the GE programme director to examine the academic quality and effectiveness of the interdisciplinary courses offered to students. It was decided to add discipline-based courses to the existing GE programme and offer them to students alongside the interdisciplinary courses in the same academic year to compare the two types of courses directly. Students were free to choose any type of GE course offered and to provide feedback to the university based on their learning experiences. As research on directly comparing the two types of courses under the same GE programme was rarely reported, it would be

valuable to learn about how students from the same cohort perceived these two types of courses and to correlate the findings to their academic outcomes.

Research Question

This study aimed to compare students’ perceptions of their learning experiences in discipline-based versus interdisciplinary courses. In addition, we would examine if there was a difference in student academic performances in the two types of courses. The research question that governed this work was, ‘Are there any differences, in terms of student perceptions of their learning experiences and academic performance, between discipline-based courses and interdisciplinary courses?’

Method

This work took place in a research-intensive, publicly funded university in Hong Kong. The GE programme was established in 2012, and all GE courses were developed as interdisciplinary courses. Every undergraduate student, regardless of his/her enrolled academic programme, was free to select any four GE courses from a pool of more than one hundred courses during their four years of undergraduate study to fulfil his/her bachelor’s degree requirement. Most of students completed all four GE courses during their first year of study. As the GE programme progressed, voices from the university community advocated adding discipline-based courses to the existing GE programme, allowing students to choose any type of GE course to be taken for their studies. As such a small number of discipline-

based courses were offered to students. There were 109 existing interdisciplinary courses and 19 newly developed discipline-based courses offered in the academic year. All courses were 3-credit courses with no prerequisites, which is suitable for all students with any academic background. Both types of courses underwent the same quality assurance process following the university policy and were granted approval from the relevant academic committee to be offered to students.

Instruments

In order to gather students' perception data on their learning experiences in the two types of courses, the institutional survey on teaching and learning – the Teaching and Learning Questionnaire (TLQ), was adopted to measure and quantify their learning experiences. TLQ is a 7-point Likert-type survey administered to students enrolled in all courses via an online system at the end of each semester by the University. Five items of the TLQ were used in this study, they were course design, encouragement to be creative/innovative, encouragement to think critically, course difficulty (in reversed scale), and overall learning experience.

Data sources

A total of 23,908 TLQ were sent out to all students enrolled in 128 courses offered in the GE programme of one academic year, there were 7,488 valid responses received, with a response rate of 31%. Out of the 128 GE courses, 19 of them were discipline-based courses with a TLQ response rate of 37%, while the 109 interdisciplinary

courses had a response rate of 30%. The alpha coefficient for the five TLQ items was .860, suggesting that the items had relatively high internal consistency. The student enrolment rate of the participating courses was recorded. It is found that the cumulated enrolment rate of the interdisciplinary courses was 87%, while the discipline-based courses had only 64% cumulated enrolment rate throughout the academic year. The enrollment rate for all the GE courses was 80%. Enrolment and TLQ data were summarized in Table 1. To compare students' academic performance between discipline-based and interdisciplinary courses, aggregated course GPAs of all 128 GE courses offered in the academic year were collected and analyzed in the subsequent section.

Results

We began our investigation by comparing students' perception data collected in the five TLQ items. Independent samples *t*-tests were performed on the TLQ data. Students reported that four out of five learning aspects in discipline-based courses were better than those of interdisciplinary courses. To understand the results, we must look into the four aspects of the learning experience individually. According to the analysis results (Table 2), students perceived that discipline-based courses were better designed ($M = 5.66$, $SD = .50$) than the interdisciplinary courses ($M = 5.46$, $SD = .58$), $t(126) = 1.38$. They also indicated that the discipline-based courses were slightly more encouraged students to be creative and innovative ($M = 5.55$, $SD = .37$), better encouragement for students to think critically ($M = 5.73$,

SD = .44) and received better overall learning experience ($M = 5.81$, $SD = .46$), as compared to these aspects, creative/innovative ($M = 5.49$, $SD = .60$), $t(126) = .51$, critical thinking ($M = 5.56$, $SD = .55$), $t(126) = 1.24$, overall experi-

ence ($M = 5.58$, $SD = .59$), $t(126) = 1.61$, that they perceived in the interdisciplinary courses. However, none of these four aspects was a significant difference in the analysis. Their corresponding size effects were either ‘small’ or ‘trivial’.

Table 1. Summary of course enrolment and Teaching and Learning Questionnaire Data

Course Type	No. of Courses	Enrolment Rate	Number of TLQ Sent	Number of TLQ Received	Response Rate
All Courses	128	80%	23,908	7,488	31%
Discipline-based Courses	19	64%	5,126	1,916	37%
Interdisciplinary Courses	109	87%	18,782	5,572	30%

The unexpected result came from the TLQ item of course difficulty. Since this item was on a reverse scale, a higher score indicated students perceived the course was more difficult. Based on the independent samples *t*-test conducted on the data, students indicated that the discipline-based GE courses ($M = 4.99$, $SD = .40$) were significantly more difficult than the interdisciplinary GE courses ($M = 4.73$, $SD = .50$), $t(126) = 2.09$, $p < 0.05$. Cohen’s $d = .57$, a ‘medium’ effect. The result puzzled our team as all GE courses were designed without prerequisites and should have identical academic levels, students should be comfortable in taking any type of GE course regardless of their majors. Even if there were variations in difficulty level in different GE courses owing to the course

designs, the discrepancy in course difficulty should not be significant, but the result indicated otherwise. This issue was discussed in detail in the next section.

In order to compare students’ academic performance in the two types of courses, independent samples *t*-test was performed on the GPA data. It was found that the cumulated GPA value of the discipline-based GE courses ($M = 2.98$, $SD = .21$) was just slightly lower than that of the interdisciplinary GE courses ($M = 3.05$, $SD = .25$), $t(126) = -1.21$, and the difference was not statistically significant and the size effect was small (Table 2).

Table 2. Comparison of TLQ and GPA of discipline-based GE courses and interdisciplinary GE courses

Item	Course Type	n	Mean	SD	Mean Diff	<i>t</i>	<i>p</i>	Cohen's <i>d</i>	Size of Effect
I found the learning experience well designed.	Discipline-based	19	5.66	.50	.20	1.38	.17	.37	Small
	Interdisciplinary	109	5.46	.58					
I was encouraged to be creative/innovative.	Discipline-based	19	5.55	.37	.05	.51	.61	.12	Trivial
	Interdisciplinary	109	5.49	.60					
I was encouraged to think critically.	Discipline-based	19	5.73	.44	.17	1.24	.22	.34	Small
	Interdisciplinary	109	5.56	.55					
I found the course difficult ^a .	Discipline-based	19	4.99	.40	.25	2.09*	.04	.57	Medium
	Interdisciplinary	109	4.73	.50					
The overall learning experience in this course was valuable.	Discipline-based	19	5.81	.46	.23	1.61	.11	.43	Small
	Interdisciplinary	109	5.58	.59					
Average GPA	Discipline-based	19	2.98	.21	-.07	1.21	.23	.30	Small
	Interdisciplinary	109	3.05	.25					

^aHigher score means more difficult

**p* < 0.05

Discussion

The results of the study revealed four aspects of the positive learning experience of discipline-based courses. The large-scale survey received more than seven thousand valid questionnaire responses from 128 GE courses. The results gave solid quantitative evidence that students perceived discipline-based courses as better in course design, encouragement to be creative and innovative, encouragement to think critically, and a better overall learning experience. However, we would like to find out why students think this way. As all the new

discipline-based courses were designed based on the same sets of academic regulations, quality assurance policy, and assessment guidelines as the existing interdisciplinary courses, there should be no difference between the two types of GE courses. Students should perceive the two types of GE courses similarly, and their perception of the learning experience should not unanimously favour one type of course. This was what the research team thought the results should be before conducting the study. Some of the team members even thought that students might favour the interdisciplinary courses as more resources had already

been devoted to supporting the existing GE courses. On the other hand, most learning activities of the newly developed discipline-based course consisted of large class-size lectures with less active learning activities. The learning approaches were more traditional and passive, with less interaction in class. We initially thought that students might give lower TLQ scores to the newly established discipline-based courses. But the research work gave the opposite result.

Students Prefer Discipline-based Courses over Interdisciplinary Courses

We thought of explaining the observation because students might be more familiar with and used to the traditional, memorization, and passive learning approach (Gan, 2009; King & Bernardo, 2016) carried out by the discipline-based GE courses. Hong Kong students were used to having passive lectures and examinations. It was a result of the examination-oriented learning environment in their six-year study in local secondary schools (Poon & Wong, 2008; Yeung, 2009). As they climbed the academic ladder, they had to overcome a series of examinations and finally went through a stressful public examination to earn their university entrance tickets. The examination-oriented learning approach was implanted in their minds. Students were comfortable and even eager to receive a similar passive learning approach in university. As the discipline-based courses were similar to or acted as a continuation of what they had experienced in the secondary school environment, they might feel that this type of learning approach and experience was better for them and might even be more

comfortable learning in this way (Kennedy, 2002; Willey & Gardner Anne, 2011). In other words, students were less comfortable changing their learning approach to a more active learning environment provided mostly by the interdisciplinary courses, where the course leaders very often requested students to engage and participate in the classrooms actively. We thought that the learning habits of our students could be the key reason affecting the result of this study.

The Constructivist Learning Theory

The Constructivist Learning Theory can provide insight into why students perceive discipline-based courses and interdisciplinary courses differently. The theory posits that learning is an active process in which students build their own understanding and knowledge based on their previous experiences (Bodner, 1986; Jonassen, 2013; Perkins, 2006). When students encounter new material, they integrate it with their prior experiences. In the case of discipline-based courses, students explore the intricate details of a single discipline, developing their understanding based on prior knowledge and progressively adding to it, creating a linear, layered knowledge structure. Conversely, interdisciplinary courses require students to amalgamate knowledge from various disciplines. Students need to draw connections across numerous academic fields and develop solutions for complex problems. The learning methodologies in both types of courses require students to build their knowledge in different ways. As a result, students often lean towards the learning style they are more accustomed to, which is the linear, layered knowl-

edge construction approach found in discipline-based courses.

Students Perceived Discipline-based Courses as More Difficult

Despite students overwhelming indicated that they had received better learning experiences in discipline-based courses, they also reported that this type of course was significantly more difficult as compared to the interdisciplinary GE courses. Were students providing conflicting feedback in the study? The discipline-based courses, which were introductory survey courses to academic disciplines or majors, tended to focus on the disciplines' concepts, theories, equations, and classic research findings. The basic discipline knowledge might be viewed as more difficult for a student with no background knowledge of the discipline to learn and comprehend the materials. For example, a student majoring in Art might need to spend more effort studying an introductory course in engineering, as the learning approach of the course could be very different from what he/she used to have in his/her major courses. But when the same art student enrolled in an interdisciplinary course, he/she could still employ his/her expertise in his/her discipline to tackle the issue posed by the course instructor. In comparison, students would think that the discipline-based courses were more difficult.

The Cognitive Load Theory

The Cognitive Load Theory suggests that our brain has a limited capacity to process new information (Chandler & Sweller, 1991; Paas, Tuovinen, Tab-

bers, & Van Gerven, 2003; Sweller, 1994). This capacity is divided into two types: intrinsic and extraneous. Intrinsic cognitive load refers to the difficulty of the material being learned, while extraneous cognitive load refers to how the material is presented and taught. In discipline-based courses, both intrinsic and extraneous cognitive loads can be high. The intrinsic load is high because it requires students to understand a specific discipline deeply. The extraneous load is also high because of the traditional teaching method of lecturing in a large-class environment with examinations. On the other hand, interdisciplinary courses can potentially reduce both types of cognitive load. By integrating knowledge from various disciplines, these courses can make the material more relatable and easier to understand, reducing the intrinsic load. They also often use more interactive and engaging teaching methods, such as group projects, presentations, or case studies, which can reduce the extraneous load. As such, students tend to find the discipline-based course more difficult due to the higher cognitive load.

Students Enrol in Less Challenging Courses

Even though students thought that discipline-based courses provided better learning experiences, they still preferred to enrol in the interdisciplinary GE course, as the enrolment rate was much higher in these courses (Table 1) than in the discipline-based courses. Our explanation for this observation was simple; students preferred to enrol in an easy course rather than a course that could provide a better learning experience.

Students were more concerned about their own academic standing and wished to obtain better grades in all the enrolled courses. So they chose the interdisciplinary courses because they thought those courses were easier to obtain higher grades. Judging from the course difficulty data perceived by the students, students tended to think interdisciplinary courses were easier, thus they rushed to enrol in those courses, resulting in a higher enrolment rate.

Academic Standing of Discipline-based Courses and Interdisciplinary Courses

The last analysis performed was the comparison of GPAs in both types of courses and the results indicated no significant difference in student academic performance. This was the result that we expected and were delighted to see. Since all GE courses were subjected to the same quality assurance policy and followed identical assessment guidelines, although different course leaders could adopt different assessment methods, the academic standing of both types of courses remained at that same level with a non-significant variation. The result indicated that students did not receive higher grades in the interdisciplinary courses despite students perceiving these courses as less challenging.

Conclusion

In this work, we successfully answered the research question of whether students perceived discipline-based courses and interdisciplinary courses differently. We directly compared the two types of courses regarding student learn-

ing experiences and academic performance. The analysis from the study, which was comprised of more than seven thousand valid responses, indicated that students thought the discipline-based courses provided better learning experiences but were more difficult to study. However, according to the analysis, there was no significant variation in academic standing in both types of courses.

We are concerned that students still prefer to choose courses that they think are easier to study instead of courses that can provide better learning experiences. Students' behavior in selecting courses is not easy to change. However, this study informs us that students actually misunderstand the difficulty level of the courses: if the discipline-based courses were more difficult, student academic performance would be lower in this type of course, but this study reveals that it is not the case.

From the results of this study, we learn that students have an incorrect perception of course difficulty, and the university will need to inform students about the nature of the courses. Better academic advising must be provided to students to educate them on the purpose and objective of the GE programme, which is to broaden their knowledge instead of merely acquiring credit units to fulfil their graduation requirements or a place to enroll in easy-to-complete courses. Correcting students' misconceptions of the discipline-based and interdisciplinary courses not only helps them to choose appropriate courses but will also enhance their overall undergraduate experience and guide them to be better, all-rounded students.

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