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Enhancement of QS Performance via Deep Learning Approaches of QS Students

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Executive Summary

Although studies of the undergraduate curricula in QS-related courses have been repeatedly undertaken by relevant professional institutions (e.g., RICS, 1963, 1971, 1983, 1989 and 1991), the quality of university graduates is still criticized by educators, senior governmental officials, and by industrial employers. While educationalists draw up what they believe is a good curriculum for students, students acquire the necessary knowledge depending on their own learning approach and attitude. The project focused on evaluating the learning approaches of QS students in Hong Kong so as to recommend the most appropriate teaching orientations for surveying education.

Based on extensive literatures, three learning approaches (surface, deep and achieving) and two teaching orientations (teacher-centered and student-centered) were established for analyzing the complicated teaching and learning process in the QS education. In general, student-centered teaching orientation encourages students to develop a deep learning approach and enhance their learning outcomes, while teacher-centered teaching orientation may promote memorization mainly.

In order to investigate the relationships between teaching orientations, learning approaches and the learning outcomes, a bilingual questionnaire survey was distributed to 304 QS students in HK and 566 QS-related students in mainland China. The results revealed two Teaching–Learning–Outcomes models for students in HK and mainland China respectively. It confirmed that a student-centered teaching orientation and a deep learning approach were popular among teachers and students respectively in the Mainland, while the Hong Kong educators applied both teacher-centered and student-centered teaching orientations evenly, and the QS students in Hong Kong adopted both surface and deep learning approaches.

The student-centered teaching orientation was more likely to be associated with the deep learning approach, the achieving learning approach, and learning satisfaction in Hong Kong and Mainland China; while the teacher-centered teaching orientation was related to the surface learning approach and negatively related to the learners' satisfaction with their academic performance in the Mainland. In order to enhance the learning approaches of QS students, educators need to interact with students and take care of their emotional and whole personal development rather than providing only a single presentation in the classroom. A close collaboration between the universities and the institution is very important. Alternative teaching methods with a student-centered teaching orientation such as group discussions, problem-based course work, management case analysis, self-cultivating activities, project-based cooperation, and additional extra-curricular activities such as study tours, summer practices, mentoring scheme and site visits are recommended for QS education, especially in the QS programs in Hong Kong. It is believed that QS graduates will be able to perform well in their jobs provided that positive learning approaches have been cultivated in universities.

Contents

1. Introduction

Construction education covers a wide range of technical and theoretical subjects, while quantity surveying (QS) education encompasses a wealth of knowledge in various applied areas such as construction technologies, construction management, cost management, and economic, contract/law, and professional skills. The curricula should reflect the dynamic needs of the society including the needs of employers and students, and the need to address wider economic and political demands. Despite the growing demands for constant curricula review and revamping, students are considered to be less prepared for university study due to a shift from elitism to a mass education model. Studies focusing on the undergraduate curricula in construction-related courses have been repeatedly undertaken by relevant professional institutions (e.g., RICS, 1963, 1971, 1983, 1989, 1991; Tam et al., 2006). However, in recent years, the quality of university graduates has been criticized by educators such as Dr. Leung, Associate Professor, Chinese University of Hong Kong (Chinese University of Hong Kong, 2006), by senior governmental officials (Financial Secretary and Secretary for Education and Manpower of the HKSAR Government), and by industrial employers such as Centralline Human Resources Consultants Ltd.

Learning consists of two aspects: *what* is learned and *how* it is learned. While educationalists draw up what they believe is a good curriculum for students, students acquire the necessary knowledge depending on their own *learning approach and attitude* (Biggs, 1992). In fact, the learning attitudes of QS students directly affect and reflect the performance of graduates when they enter the industry. This project focused on evaluating the learning approaches of QS students in Hong Kong so as to recommend the most appropriate teaching orientations for surveying education. The goal of the project was to meet the following objectives:

1. to review the literature regarding learning approaches and teaching orientations;
2. to investigate the learning approaches of QS students;
3. to investigate the teaching orientations found in QS education;
4. to evaluate the relationships between the identified learning approaches (refer to item 2), the teaching orientations (item 3), and the learning outcomes; and
5. to recommend the most appropriate teaching orientations for QS education.

2. Approaches to Learning

The knowledge and skills associated with QS need to be developed through appropriate teaching orientations and learning approaches. This is a complicated process involving many factors (Hativa, 2000; Ramseden, 2003). Students' approaches to learning comprise two major components: learning motives and learning strategies. A learning motive is the student's motivation, which tends to determine the learning strategies that the student will adopt; the learning strategy adopted will subsequently influence the student's learning outcomes (Biggs, 1987; Leung, 2003; Leung et al., 2004). Based on the three learning

motives and the three learning strategies, three learning approaches (surface, deep, and achieving) were established by Biggs (1979, 1987, 1992) (see Table 1), and a matrix of learning approaches was developed by Leung et al. (2004) for analyzing the complicated learning phenomenon in a real education process.

Table 1 Learning Motives and Learning Strategies (Maton and Säljö, 1976; Biggs, 1979, 1987, 1992; Leung et al., 2008)

Learning Approaches	Learning Motives →	Learning Strategies
Surface Approach	Students carry out the tasks with surface motive (SM) because of extrinsic motivation. They only want to pass the tasks.	Students using a surface strategy (SS) thus mainly focus on the most important topics or elements and reproduce them. They do not see interactions between pieces of knowledge.
Deep Approach	Students with deep motive (DM) really want to engage tasks properly due to intrinsic motivation. Learning for the students is to satisfy their thirst for knowledge.	Students using a deep strategy (DS) implement tasks at a high cognitive level such as by searching for analogies and by relating new knowledge to previous knowledge. The students love knowledge. They play with the task and think about it constantly.
Achieving Approach	Students with achieving motive (AM) usually relate to products (e.g., high grades and winning prizes).	Students using an achieving strategy (AS) try their best to obtain high marks. There is no fixed method in their learning process, but it must involve optimal engagement with the task which helps them to earn the highest marks.

Note: Learning motive is the reason for learning; it can be tangible or intangible.
Learning strategy relates to the method of learning

Maton and Säljö (1976) described two qualitatively different ways that students approach their learning: the surface approach and the deep approach. Students employing a *surface approach* view learning as acquiring knowledge, therefore they orient their learning toward memorization and reproduction for passing examinations only. In contrast, students adopting a *deep approach* are intrinsically motivated. They are interested in the subject, so they take the initiative in seeking knowledge for understanding and learning.

Biggs (1987, 1992) extended this theory and proposed another learning approach: the *achieving approach*. Students adopt this learning approach based on personal ambitions such as a desire for pride and achievement. To obtain high grades or to win prizes, this type of student applies optimized strategies, such as by fully utilizing study periods and by following their teachers' instructions closely (Biggs, 1992).

3. Orientations to Teaching

One of the main factors that affect students' learning is their educators' orientation to teaching. Besides construction knowledge and skills (what is taught) such as construction technology and measurement, the teaching orientation (how it is taught) is a major element influencing the performance of students in universities and of graduates in industry (Ramsden, 2003).

By using metaphors, two general types of teaching theory (orientations) were developed (Fox 1983). These are *simple theories* and *development theories*. Simple theories, including *transferring* and *shaping* teaching approaches, indicate that knowledge is simply transferred to and received by students. In the development theories, including *traveling* and *growing* approaches, teachers need to help students gain knowledge and develop themselves based on their own experiences and ideas. The growing approach needs to take care of the internal personal growth of a student. Therefore, the transferring and shaping teaching approaches (simple theory) involve a teacher-centered orientation, while the traveling and growing teaching approaches (development theory) involve a student-centered orientation.

Table 2 Two Teaching Orientations (Leung et al., 2008)

Teaching Orientations	Teaching Approaches *		Teaching Methods
Simple theories * / Teacher-centered # / Content-oriented ^	**Transferring**	Teachers concentrate on the act of transfer.	This is usually called "Spoon-fed" Education. Lectures are seen as the classical way to transfer knowledge.
	Shaping	Teachers view students as metal or clay to be shaped to a predetermined form.	Teachers demonstrate experiments or examples at first, followed by setting exercises whereby the qualities are fashioned in the students.
Development theories * / Student-centered # / Learning-oriented ^	**Traveling**	Education is seen as a journey. Teachers usually guide, lead, and point the way to students.	Teachers do not give students a model answer to follow but support them with some guidelines or sharing. Independent learning and group discussion are the common methods used.
	Growing	Focuses on what is happening to the student as a person rather than exploring the outside world and mastery of the subject.	Students do not get answers directly from teachers until they overcome problems in their lives. Students confront problems and conceptualize their own views.

Note: * refers to Fox (1983); # refers to Trigwell et al. (1994); ^ refers to Kember (1997).

4. Impacts of Teaching and Learning

In general, traveling and growing teaching approaches are more likely to encourage students to develop a deep learning approach (Sheppard and Gilbert, 1991) and enhance their learning outcomes (Gow and Kember, 1993). For example, practical problems (growing approach) can encourage students to participate in the learning process directly, and site visits can stimulate students' interest in a subject. However, simple one-way transferring and shaping teaching orientations may encourage students to mainly memorize knowledge, and they do not promote deep learning. Hence, the teaching orientation is considered to be an intervening variable in the learning process.

An extensive literature review has also revealed that there are some relationships between learning approaches and learning outcomes (Trigewell et al., 1994; Prosser and Trigwell,

1999; Biggs, 1992; Marton and Säljö, 1976; Ramsden, 2003). When students work hard but obtain poor results, this could be due to an inefficient application of a surface approach to studying (Kember et al., 1995). Students with a deep learning approach are interested in the subject and really spend time to gain understanding (information searching and logical thinking). Those who adopt a deep learning approach can achieve better academic performance than those employing a surface approach and, thus, can gain higher satisfaction from the learning process (Watkins, 1983). A hypothetical model of teaching, learning, and the learning outcomes is illustrated in Figure 1.

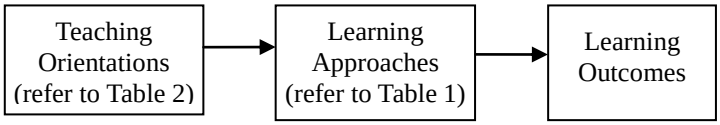

Figure 1 Hypothetical Model of Teaching–Learning–Outcomes for QS Students

5. Methodology

5.1 Questionnaire Description

A cross-country survey was conducted of the QS students in Hong Kong and the QS-related students who learned cost-related subjects in Mainland China and other regions. The questionnaire used in this study consists of four parts: (1) Personal particulars, (2) Learning approaches, (3) Teaching orientations, and (4) Satisfaction.

The first part focused on collecting respondents' demographic information, including gender, age, area, university, programs, year of study, and work experience. A 7-point scale ranging from *not enough* (1) to *enough* (7) was used to obtain students' opinions about the sufficiency of the knowledge received in their universities.

The second part consists of 18 items that were adapted from Biggs's Study Process Questionnaire (SPQ); it focused on measuring respondents' perceptions of approaches to learning (Biggs, 1987). This SPQ inventory has been proved stable, reliable (Cornell, 1986), and consistent in various psychological education and construction studies (Jones and Jones, 1996; Leung et al., 2007). All items in the second part used a 7-point scale ranging from *rarely true / strongly disagree* (1) to *always true / strongly agree* (7).

The third part, consisting of 16 items, focused on evaluating the respondents' perceptions of the teaching orientations they experienced during their learning processes. All questions in this part used a 7-point scale ranging from *strongly disagree* (1) to *strongly agree* (7).

The fourth part focused on measuring respondents' satisfaction levels regarding their learning outcomes, including their satisfaction with their academic performance and extra-curricular

activities. The questions in this part also used a 7-point scale ranging from *very low/poor* (1) to *very high/excellent* (7).

5.2 Descriptions of Samples

In all, 1,301 questionnaires were collected from six regions including Mainland China (566), Hong Kong (304), Singapore (180), Japan (36), Australia (175), and Canada (40). As the research study focused on the learning approaches of QS students in China, the sample information for Mainland China and Hong Kong is listed in Table 3.

Table 3 Descriptions of Samples in Hong Kong and Mainland China

Items		Mainland China	Hong Kong	Total
Gender	Male	346	163	509
	Female	220	141	361
Age	Below 18	1	0	1
	18-19	43	59	102
	20-21	277	171	448
	22-23	184	68	252
	24-25	50	3	53
	Above 25	9	1	10
Number of disciplines		5	1	6
Number of universities		5	3	8
Year of study	Year 1	53	123	176
	Year 2	214	122	336
	Year 3	233	59	292
	Year 4	66	--	66
Work experience	Yes	59	144	203
	No	506	155	661
Knowledge sufficiency	Mean Scores	2.59	3.83	3.02

The survey was conducted in collaboration with teachers/scholars in six regions including Mainland China and Hong Kong. A bilingual questionnaire for anonymous respondents in Chinese and English was distributed to QS students in Hong Kong, and to construction management students who learned costing in the Mainland and other regions, during a class break with the help of teachers/scholars. The questionnaire was then collected afterwards.

Mainland China sample. There were 566 undergraduates (346 males and 220 females) from five universities (i.e., North China Institute of Science and Technology, Beijing Jiao Tong University, Dongbei University of Finance and Economics, Jiangxi University of Science and Technology, Xi'an University of Architecture and Technology) in Mainland China who took part in this study. Most of the participants (554) ranged in age from 18 to 25, while one participant was below 18, nine were above 25, and two did not specify their ages. Since pure QS programs are not common in Mainland China, and undergraduates in other disciplines are eligible to become cost engineers (or quantity surveyors) in Mainland China, the study accepted respondents who were studying in different construction-related programs including 8.3% of total respondents from architecture, 10.2% from quantity building

surveying, 70.8% from construction engineering and management, and 0.7% from building/project management. However, all of these programs include at least one QS course that the respondents would have taken. With regard to year of study, 9.4%, 37.8%, 41.2%, and 11.7% of the respondents were studying in years 1, 2, 3, and 4 respectively. The majority of the participants (89.4%) had not had any work experience. The respondents reported that their knowledge gained in the university was far from enough. (This item only scored 2.59 on average out of 7 points.)

Hong Kong sample. There were 304 respondents (163 males and 141 females) from three universities (i.e. City University of Hong Kong, the Hong Kong Polytechnic University, and the University of Hong Kong) who took part in the QS. The ages of the respondents were mainly between 18 and 25 (99.7%); only one respondent was above 25, and two others did not specify their ages. With the exception of one participant who did not specify his discipline, all the respondents (303) were studying in surveying programs. With regard to year of study, 40.5% and 40.1% were in year 1 and year 2, respectively, and the remaining 19.4% were studying in year 3. Almost half (48.2%) had some work experience. The mean score they ranked for knowledge sufficiency was 3.83.

6. Data Analysis

6.1 Approaches to Learning

6.1.1 Identification of Learning Factors

Factor analysis was conducted to obtain meaningful constructs of learning approaches. To obtain a common platform for further study in the future, this study conducted a factor analysis based on all the data collected from the six regions. Since this research just focuses on QS education in Mainland China and Hong Kong, the subsequent data analysis is specifically analyzed based on these two regions. Table 4 shows that five factors of learning approaches (F1, F2, F3a, F3b, and F4) were obtained by principal components factor analysis with Varimax rotation (Eigenvalue = 1 was used as a cut-off).

Table 4 Factor Analysis of Learning Approaches

Factor	Label	Variable	Question	Factor Loading	Alpha
F1	Deep Learning	V11	I find that I have to do enough work on a topic so that I can form my own point of view before I am satisfied.	0.662	0.637
		V10	I would see myself basically as an ambitious person and want to get to the top whatever I do.	0.651	
		v9	I feel that virtually any topic can be highly interesting once I get into it.	0.586	
		v4	While I am studying, I often think of real life situations to which the material that I am learning would be useful.	0.575	
		v6	While I realize that truth is forever changing as knowledge is increasing, I feel forced to discover what appears to me to be the	0.404	

			truth at this time.		
		~~v2~~	~~I find that at times studying gives me a feeling of deep personal satisfaction.~~	~~0.371~~	
F2	Achieving Learning	V13	After a lecture or lab, I re-read my notes to make sure that they are legible and that I understand them.	0.770	0.696
		V17	I make a point to studying most of the suggested readings that go with the lectures.	0.698	
		v8	I try to work consistently throughout the term and review regularly when exams are close.	0.618	
		V15	I find most new topics interesting and often spend extra time trying to obtain more information about them.	0.614	
F3a	Surface Learning	v3	I want top grades in most or all of my courses so that I will be able to select from among the best positions available when I graduate.	0.674	0.529
		v5	I am discouraged by poor mark on a test and worry about how I will do on the next test.	0.642	
		v1	I choose my present courses largely with a view of the job situation when I graduate rather than out of their intrinsic interest to me.	0.514	
F3b	Surface Learning	V16	I find it best to accept the statements and ideas of my lecturers and question them only under special circumstances.	0.767	
		V18	I am very aware that lecturers know a lot more than I do and so I concentrate on what they say which is important, rather than rely on my own judgment.	0.686	
		V14	Lecturers shouldn't expect students to spend significant amounts of time studying material everyone knows won't be examined.	0.512	
~~F4~~		~~V12~~	~~If it came to the point, I would be prepared to sacrifice immediate popularity with my fellow students for success in my studies and subsequent career.~~	~~0.746~~	~~0.323~~
		~~v7~~	~~I learn some things by rote, going over and over them until I know them by heart.~~	~~0.418~~	

Notes: all items were measured on a 7-point scale;
"~~xxx~~" - items with the factor loading less than 0.4 were deleted in the subsequent analysis; factors with alpha values less than 0.5 were deleted in the subsequent analysis; or items with meaning inconsistent with other items in the same factor were deleted.
F3a and F3b are combined as F3 – surface learning.

IN this cross-cultural study, only those items with factor loadings greater than 0.40 were accepted and retained in this research in order to ensure construct validity (Stevens, 1996); therefore variable v2 was deleted. F4 was deleted in the subsequent analysis due to its low internal consistency ($\alpha < 0.5$). Variables in factors F3a and F3b cover the surface learning items; therefore these two factors were combined in the subsequent analysis. Finally, three learning approach factors were formed; these include deep, achieving, and surface learning approaches with Cronbach's alpha values of 0.637, 0.696, and 0.529, respectively.

6.1.2 Mean Scores of Learning Approaches and Numbers of Learners

The mean scores for the surface, deep, and achieving learning approaches for students from Mainland China were 4.11, 4.77, and 3.90, respectively (see Table 5). The results indicated that the mean scores for the deep learning approach of Mainland students are significantly higher than those for the achieving learning approach (t =18.77; p =0.000) and the surface learning approach (t =13.03; p =0.000); while the mean scores for the surface learning

approach is significantly higher than those for the achieving learning approach (t =4.19; p =0.000). This indicates that the deep learning approach is much more popular than the surface learning approach, while the achieving learning approach is the least popular learning approach adopted by QS-related students in Mainland China.

The mean scores for the three learning approaches for Hong Kong students were 4.37, 4.32, and 3.81, respectively. The mean scores for the surface and deep learning approaches are significantly higher than those for the achieving learning approach (t =9.80, p =0.000; and t =10.73, p =0.000, respectively). This indicates that both the surface and deep learning approaches are commonly adopted by QS students in Hong Kong, while the achieving approach is also the least popular learning approach adopted by them.

Table 5 Mean Scores of Learning Approaches and Numbers of the Three Types of Learners

Learning Approaches	**Mainland China (*N* = 559)**		**Hong Kong (*N* = 298)**		***t*-value**	***p*-value of *t* test**
Surface Learning/Learners (SL)	4.12 [1]	*128.5* [3]	4.37	*126.50*	- 4.40	0.000
	0.84 [2]	*24%* [4]	0.68	***44%***		
Deep Learning/Learners (DL)	**4.77**	*338.0*	4.32	*122.50*	6.85	0.000
	1.01	***63%***	0.73	***43%***		
Achieving Learning/Learners (AL)	3.90	*65.50*	3.81	*37.00*	1.23	0.221
	1.10	*12.2%*	0.86	*13%*		
Comparison among 3 Approaches	***t*-value**	***p*-value**	***t*-value**	***p*-value**		
DL -AL	18.77	*0.000*	10.73	*0.000*		
DL -SL	13.03	*0.000*	- 1.00	*0.317*		
SL -AL	4.19	*0.000*	9.80	*0.000*		
	DL > SL > AL		**DL /SL > AL**			

Note: *N* – number of respondents;

[1] Figures in the upper left corner are the mean scores, which represent degree of agreement on the items in each factor; "1" means *strongly disagree* and "7" means *strongly agree*;

[2] Figures in the lower left corner are standard deviations of the mean scores;

[3] Figures (in italic) in the upper right corner are the numbers of respondents;

[4] Figures (in italic) in the lower right corner are percentages of the total number of respondents in the particular location.

In order to avoid any statistical measurement bias, this study further classified each respondent into one of three different categories, namely surface learner, deep learner, and achieving learner, according to their scores for these three learning approaches. Respondents who scored highest on the surface learning factor were categorized as surface learners, and similarly, the classifications of deep learner and achieving learner were determined based on the scores. The results show that most of the Mainland students are deep learners (63%). Also, most of the Hong Kong QS students are surface learners (44%) or deep learners (43%). In general, students are least likely to adopt achieving learning approaches (mean = 3.90 and 3.81) or to be achieving learners (12.2% and 13%) in both regions.

The results of the t test for learning approaches indicated that the mean scores for the surface and deep learning approaches for Mainland China and Hong Kong students were significantly

different (t = 6.95, p = 0.000; t = -6.85, p = 0.000). This indicates that the application of surface and deep learning approaches in these two regions is different.

6.2 Teaching Orientations

6.2.1 Identification of Teaching Factors

As mentioned in Section 6.1.1, this study conducted a factor analysis based on the overall data collected from six regions, while the subsequent data analyses (correlation analysis and *t* test) were specifically based on the data from two regions: Mainland China and Hong Kong.

The 16 items on teaching orientations in the third part of the questionnaire were analyzed. Table 6 shows that four factors (F1, F2a, F2b, and F3) were obtained by a principal components factor analysis using Varimax rotation (Eigenvalue = 1 was used as a cut-off). Variables v2 and v15 were deleted because the meanings of the variables were quite different from the meanings of other variables in the same factors (F1 and F2a respectively). F3 was excluded from the subsequent analysis due to its low internal consistency ($\alpha < 0.5$). Variables of factors F2a and F2b include similar teacher-centered variables. Therefore, these two factors were combined. Finally, two teaching factors were formed. These include teacher-centered and student-centered teaching orientations with Cronbach's alpha values of 0.695 and 0.560, respectively, indicating reliable internal consistency.

Table 6 Factor Analysis of Teaching Orientations

Factor	Label		Variable	Factor Loading	Alpha
F1	Student-centered teaching orientations	v8	My teachers help me to develop my personality.	0.725	0.695
		v4	My teachers are more concerned about my intellectual and emotional development than my academic results.	0.698	
		v12	My teachers help me to solve both personal and academic problems.	0.682	
		v3	Guidance is given by my teachers to enable us to explore knowledge.	0.570	
		v7	Discussion with students, instead of presentation to students, is the common teaching method of my teachers.	0.547	
		~~v2~~	~~Laboratory, workshop, or studios is the main teaching method used by my teachers.~~	~~0.444~~	
F2a	Teacher-centered teaching orientations	v1	Teachers are the unique learning medium to transfer knowledge to me.	0.704	0.560
		v5	Learning is like a photocopying process for me; I only copy knowledge from my teachers.	0.679	
		~~v15~~	~~I need to explore knowledge by myself in my individual learning.~~	~~0.545~~	
F2b	Teacher-centered teaching orientations	v13	My teachers are not concerned whether students have understood the knowledge or not.	0.732	
		v14	I still get a low mark if my answer is creative but does not follow the teacher's model answer.	0.699	
		v6	Outcomes are predetermined by the lecturers/tutors before solving the problems or doing experiments	0.449	
~~F3~~		~~v9~~	~~Compared with other learning media (e.g. presentation, game, group discussion, etc.), lectures, notes, and essential readings are~~	~~0.678~~	~~0.384~~

	~~the most common media that I use.~~	
~~v10~~	~~My assignments have model answers. The closer to the answers, the higher mark I get~~	~~0.528~~
~~v16~~	~~I am interested in my study due to the good teaching of my teachers.~~	~~0.474~~
~~v11~~	~~My teachers enjoy sharing their experience with me.~~	~~0.420~~

Notes: all items were measured on a 7 point scale

"~~xxx~~" - items with the factor loading less than 0.4 were deleted in the subsequent analysis; factors with alpha values less than 0.5 were deleted in the subsequent analysis; or items with meaning inconsistent with other items in the same factor were deleted.

F2a and F2b are combined as F2: Student-centered teaching orientation

6.2.2 Mean Scores for Teaching Orientations

The Mainland China student scores for the student-centered teaching orientations (mean =3.53) were significantly higher than their scores for the teacher-centered teaching orientations (3.37; t =2.39, $p < 0.05$), while the Hong Kong QS students rated these two teaching orientations closely (3.89 and 3.91, respectively; t = -0.403, p =0.687).

Table 7 Mean Scores for Teaching Orientations and Numbers of the Two Types of Educators

Teaching Orientations	**Mainland China (*N* = 562)**		**Hong Kong (*N* = 299)**		***t*-value**	***p*-value of *t* test**
Student-centered Teaching Orientation (STO)	3.53 [1] *1.07* [2]	*304.5* [3] ***54%*** [4]	3.89 *0.80*	*149.0* ***49%***	- 5.17	0.000
Teacher-centered Teaching Orientation (TTO)	3.38 *0.98*	*259.5* ***46%***	**3.91** *0.69*	*153.0* ***51%***	- 8.51	0.000
Comparison between two orientations	***t*-value**	***p*-value**	***t*-value**	***p*-value**		
STO-TTO	2.39	*0.017*	- 0.403	*0.687*		
	STO > TTO		STO ≈ TTO			

Note: *N* – number of respondents;

[1] Figures in the upper left corner are the mean scores, which represent degree of agreement on the items in each factor; "1" means *strongly disagree* and "7" means *strongly agree*;

[2] Figures in the lower left corner are standard deviations of the mean scores;

[3] Figures (in italic) in the upper right corner are the numbers of respondents; and

[4] Figures (in italic) in the lower right corner are percentages of the total number of respondents in the particular region.

For the same reason mentioned in section 6.1.2, the numbers of student-centered and teacher-centered educators in these two regions were calculated. Most students in Mainland China (54%) believed that their educators adopted student-centered teaching orientations, while more than half of the total respondents (51%) from Hong Kong noted that their educators were applying teacher-centered teaching orientations.

The *p*-values of the *t* test for teaching orientations for Mainland China and Hong Kong also indicated that there were significant differences in both student-centered and teacher-centered teaching scores between these two regions (t=5.17, p=0.000; and t=8.51, p=0.000 respectively).

6.3 Relationships between Teaching, Learning, and Satisfaction

6.3.1 Relationships between Teaching Orientations and Learning Approaches

According to the findings of Prosser and Trigwell (1999), student-centered teaching orientations are more likely to be related to deep learners, and teacher-centered teaching orientations may cause students to adopt a surface learning approach. The student-centered teaching orientation is beneficial in encouraging students to adopt an achieving learning approach. However, Leung et al. (2004) found that the impacts of teaching orientations on learning approaches may vary in different regions. The current study partially confirmed the findings of Prosser and Trigwell (1999).

Analysis of the Mainland China sample found that student-centered teaching orientation was significantly correlated to all learning approaches (see Table 8; r =0.115, 0.185, 0.357 and; p < 0.05, 0.001, and 0.001, respectively) and that teacher-centered teaching orientation was significantly related to surface learning (r =0.260, p =0.000). The relationship coefficient between teacher-centered teaching orientation and surface learning (r =0.260, p =0.000) was greater than that between student-centered teaching orientation and surface learning (r =0.115, p < 0.05) for the Mainland students. This implies that a teacher-centered teaching orientation is more critical for determining Mainland students' surface learning approach.

Table 8 Relationships between Teaching Orientations and Learning Approaches

Regions	Teaching Orientations	Learning Approaches		
		SL	DL	AL
Mainland China	TTO	**0.260*** **	0.025	0.001
	STO	**0.115** **	**0.185*** **	**0.357*** **
Hong Kong	TTO	**0.395*** **	0.086	**0.180** **
	STO	0.110	**0.313*** **	**0.418*** **

Notes: SL – surface learning; DL – deep learning; AL – achieving learning;
TTO – teacher-centered teaching orientation; STO – student-centered teaching orientation;
* – significant at the 0.10 level;
** – significant at the 0.05 level; and
*** – significant at the 0.001 level.

The Hong Kong sample demonstrated significant relationships between teaching and learning. Both deep and achieving learning approaches were significantly related to student-centered teaching orientation (r = 0.313 and 0.418, p = 0.000), while both surface and achieving learning approaches were significantly associated with teacher-centered teaching orientation (r =0.395, p =0.000 and r = 0.180, p < 0.05). These results are consistent with the findings of Prosser and Trigwell (1999) and Leung et al. (2004). The strong correlations implied that the particular teaching orientation (student-centered) played significant roles in determining the learning approaches (achieving learning approach) of QS students.

6.3.2 Relationships between Learning Approaches and Learning Satisfaction

The learning outcome was measured in two dimensions of the study: satisfaction with academic performance and satisfaction with extra-curricular activities. The results (see Table 9) revealed that deep and achieving learning approaches were positively significantly related to learning satisfaction (both academic performance and extra-curricular activities) in Mainland China (r =0.183, 0.254, 0.293, and 0.163, p =0.000) and to academic satisfaction in Hong Kong (r =0.188 and 0.250, p =0.000). The relationships between the deep and achieving learning approaches and satisfaction with extra-curricular activities were significant in Hong Kong, but they were not as strong as in Mainland China (r =0.147, p < 0.05; and r =0.137, p < 0.1). However, there was no significant relationship between surface learning and satisfaction in the two regions (p > 0.10).

Table 9 Relationships between Teaching, Learning, and Satisfaction

Regions	Satisfaction	Learning Approaches			Teaching Orientations	
		SL	DL	AL	TTO	STO
Mainland China	SAT1	0.042	0.183***	0.254***	-0.090*	0.247***
	SAT2	0.043	0.293***	0.163***	0.020	0.086*
Hong Kong	SAT1	-0.002	0.188***	0.250***	0.053	0.290***
	SAT2	0.018	0.147**	0.137*	0.062	0.265***

Notes: SL – surface learning; DL – deep learning; AL – achieving learning;
TTO – teacher-centered teaching orientation; STO – student-centered teaching orientation;
SAT1- satisfaction of academic performance; SAT2 – satisfaction of extra-curricular activities;
* – significant at the 0.10 level;
** – significant at the 0.05 level; and
*** – significant at the 0.001 level.

6.3.3 Relationships between Teaching Orientations and Learning Satisfaction

Table 9 shows that there was no positive significant relationship between the teacher-centered teaching orientation and learning satisfaction in both regions. Furthermore, the teaching-centered teaching orientation is negatively related to satisfaction with academic performance for Mainland students. The student-centered teaching orientation was strongly significantly correlated to learning satisfaction (for both academic performance and extra-curricular activities in Hong Kong (r = 0.290 and 0.265, p = 0.000) and to academic satisfaction in Mainland China (r =0.247, p =0.000), but it was only moderately significantly related to satisfaction with extra-curricular activities in Mainland China (r = 0.086, p < 0.10).

7. Observation

This study explored teaching and learning in QS education in Hong Kong and in QS-related education in Mainland China. Respondents in Mainland China were more disappointed with their surveying education program, as students gave lower scores on *knowledge sufficiency learned in universities* (mean = 2.59) than the respondents in Hong Kong (3.83).

As Mainland China is a developing country, QS education has not yet fully developed. Therefore, *QS-related students generally commented that there remains a lot of room for further improvement in the future*.

Three learning approaches (surface, deep, and achieving) and two teaching orientations (teacher-centered and student-centered) were described in the study, though the detailed variables in each factor may not be identical with the variables of the factors which were originally designed to be measured. The relationships between the two teaching orientations, the three learning approaches, and the satisfaction of QS students in Hong Kong and of QS-related students in Mainland China are illustrated in Figures 2a and 2b.

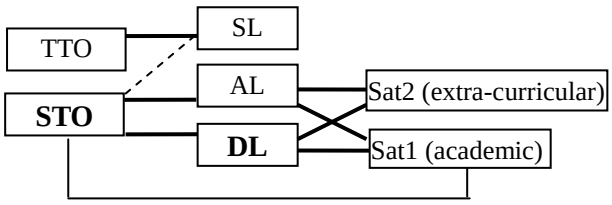

Figure 2a Teaching–Learning–Outcomes Model for QS-related students in the Mainland

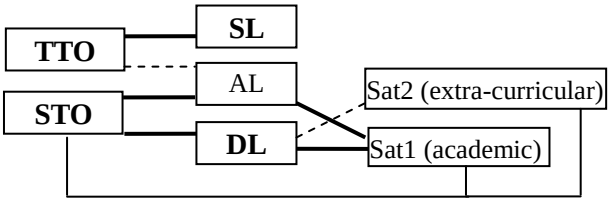

Figure 2b Teaching–Learning–Outcomes Model for QS students in Hong Kong

Notes: TTO – teacher-centered teaching orientation; STO – student-centered teaching orientation;
SL – surface learning; DL – deep learning; AL – achieving learning;
SAT1- satisfaction of academic performance; SAT2 – satisfaction of extra-curricular activities;
- - - - - - - correlation coefficient at the significant level less than 0.05; and
——— correlation coefficient at the significant level less than 0.00.

The results revealed that the deep learning approach was the dominant learning approach in Mainland China, while both surface and deep learning approaches were popular in Hong Kong. These results are consistent with Zhang (2000) who found that the mean scores for deep learning (deep motive and deep strategy) were much higher than those for surface learning (surface motive and surface strategy) in Mainland China (Nanjing Sample). Therefore, it was confirmed that the *deep learning approach was popular in Mainland China*.

People normally criticize higher education in Mainland China based on the idea that a one-way teaching method (a presentation in a large class without interaction with students) is used there (Yuan, 2004). Hong Kong, as a modernized city, should be more concerned about students in the education process. However, this study revealed the interesting results that *QS-related students in Mainland China rated the student-centered teaching orientation as the most common teaching orientation*, while *Hong Kong QS students noted that their educators applied both student-centered and teacher-centered teaching orientations*. This indicates that students in Mainland China generally feel themselves to be at the center of the learning process and are taken care of by their teachers.

Although this study found a correlation between student-centered teaching orientation and surface learning approaches in Mainland China, it still confirmed that *there are associations between teacher-centered teaching orientation and surface learning approaches*, and *between*

student-centered teaching orientation and deep or achieving learning approaches in QS education in both regions. The study confirmed that the teaching orientation is one of the major factors influencing the learning approaches of QS students. Apart from the fundamental surveying knowledge and skills (e.g., construction technology, economic, measurement, etc.), it is **recommended that student-centered teaching orientations be adopted in QS education, such as group discussion, problem-based course work (Trigwell, 1994; Wang, 2002), management case analysis, industrial mentoring scheme, and self-cultivated activities (Zimmerman, 1986).** Educators need to **interact with students and take care of their emotional and personal development rather than providing a simple presentation in the classroom.** In fact, extensive literature has reported that a student-centered teaching orientation can enhance students' interest in learning (Gow and Kember, 1993), can ensure learning concentration (Zimmerman, 1989), and can improve learning outcomes (Sheppard and Gilbert, 1991). Furthermore, students also like to explore knowledge by themselves during the learning process. It is thus also **suggested that universities should cooperate with industry to develop learning projects**. Through participation with some supervision and guidelines, students can gain practical knowledge and experiences directly. This will definitely increase their learning interests and, hopefully, will obtain better learning outcomes.

On the other hand, the teacher-centered teaching orientation was also related to the surface and achieving learning approaches of QS students in Hong Kong. These two significant correlation coefficients between teacher-centered teaching orientation and learning approaches (surface and achieving) for the Hong Kong group were higher than for the Mainland group. Such a phenomenon may imply that Hong Kong QS students rely on the teaching orientations adopted in the education process more than do Mainland students. Perhaps other intrinsic elements are involved in positively motivating the learning approach of Mainland students. **Further research on the learning approaches of QS-related students in the Mainland is thus recommended**, in order to identify the major components of the learning approaches and to enhance the learning approaches of QS students in Hong Kong.

Traditional psychological education (Marton and Säljö, 1976; Entwistle and Ramsden, 1983) normally pointed out that the deep learning approach supports the learning process with positive results. The results of this study showed that *deep learning approaches can induce high satisfaction levels (for both academic and extra-curricular activities) in Hong Kong and Mainland China*, but the relationship between satisfaction levels with extra-curricular activities and the achieving learning approach is weak in Hong Kong. This indicates that Hong Kong students who apply the achieving learning approach mainly focus on their studies in order to obtain high marks and may not really like to join in extra-curricular activities. In order **to establish well-rounded personal development, QS education should also include extra-curricular activities such as study tours, summer practices, role playing, tutorial projects, and site visits into courses**. QS education is not only a theoretical calculation,

but also involves wide organizational behavioral techniques and skills. Professional QS need to work with different construction stakeholders in the industry; therefore QS students need to develop their organizational skills through various extra-curricular activities in the university (e.g., leadership, communication, and planning).

Student-centered teaching orientations were generally more effective in this study than teacher-centered teaching orientations, as the student-centered teaching orientation was mostly seen to be associated with deep and achieving learning approaches. Therefore, the student-centered teaching orientation is recommended; it should be preferentially applied to encourage deep learning and produce satisfactory learning outcomes.

8. Limitations and Further Research

Due to limited resources, the sample sizes in Mainland China were relatively small when compared to all the QS-related students in the whole Mainland, and this may affect the resulting reliability. However, the research methodology used in this study could partly reduce the risks of these limitations. First, the questionnaire survey of learning approaches and teaching orientations had been used in previous studies and had proved to be reliable (Biggs, 1987; Zhang, 2000; Leung et al., 2008). Second, the alpha values of the subscales were higher than the acceptable level. Therefore, we are confident that the results are not biased.

To validate the results obtained in this study, further investigations with deliberate questionnaire translations and a survey with a large sample size are recommended. In order to facilitate QS students to adopt a positive deep learning approach, further study on other crucial factors such as personal value, national culture, assessment methods, and social politics are strongly recommended.

9. Conclusions

A lot of QS supervisors/employers indicated that they basically do not expect QS graduates to be solving practical problems in real projects, but QS graduates should, at least, be well prepared to work, take the initiative to search for information, seek support, and try to solve the problems encountered in the job. Learning approaches of QS students in universities directly affect their performance in the industry once they have graduated (e.g. graduates who are used to surface learning might carry out a cost estimation without searching for sufficient information or applying critical thinking). The study examined the teaching orientations used in QS programs, the learning approaches of QS (or QS-related) students, and the satisfaction of QS (or QS-related) students in Hong Kong and Mainland China, in order to provide possible solutions for the enhancement of QS education in Hong Kong.

Three learning approaches (surface, deep, and achieving) and two teaching orientations (teacher-centered and student-centered) were described in the study. Two different Teaching–Learning–Outcomes Models were established for QS students in Hong Kong and QS-related students in Mainland China, respectively. The study confirmed that a student-centered teaching orientation and a deep learning approach were popular among teachers and students respectively in the Mainland, while the Hong Kong educators applied both teacher-centered and student-centered teaching orientations evenly, and the QS students in Hong Kong adopted both surface and deep learning approaches.

The results confirmed that the student-centered teaching orientation was more likely to be associated with the deep learning approach, the achieving learning approach, and learning satisfaction in Hong Kong and Mainland China; while the teacher-centered teaching orientation was related to the surface learning approach and negatively related to the learners' satisfaction with their academic performance in the Mainland. In order to enhance the learning approaches of QS students, educators need to interact with students and take care of their emotional and whole personal development rather than providing only a single presentation in the classroom. A close collaboration between the universities and the institution is very important. Alternative teaching methods with a student-centered teaching orientation such as group discussions, problem-based course work, management case analysis, self-cultivating activities, project-based cooperation, and additional extra-curricular activities such as study tours, summer practices, mentoring scheme and site visits are recommended for QS education, especially in the QS programs in Hong Kong. It is believed that QS graduates will be able to perform well in their jobs provided that positive learning approaches have been cultivated in universities.

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