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INTERNATIONAL & COMPARATIVE EDUCATION | RESEARCH ARTICLE

Epistemological beliefs, approaches to learning, and student performance in a UK Master's programme with high Chinese enrolment

Lee A. Evans[1], Marco G. Ercolani[2]* and Peter Davies[3]

Abstract: Given that a large proportion of Master's students in UK universities are from mainland China, we sought to quantify the extent to which their approaches to learning (AtL) and epistemological beliefs (EBs) differ from those of non-Chinese students, and how these differences affected first-semester grades. To this end, we surveyed a large cohort of Master's students ($n = 564$, 65.3% Chinese) at a UK Business School at the beginning of an academic year to minimise influences that might change attitudes towards AtL and EBs. Primary data on AtL and EBs were collected using two standard survey instruments, along with data on social class, prior attainment, and nationality. This unique combination of measures, controls and large sample size allowed for an analysis that was more comprehensive than previous studies. Our findings showed that achievement among Chinese students was unrelated to AtL but was associated with EBs and social background. For example, when controlling for other factors, Chinese students who had confidence in their learning ability achieved higher grades, while non-Chinese students who perceived knowledge as certain underperformed. Moreover, Chinese students whose fathers held lower status jobs achieved significantly higher grades when controlling for other characteristics.

Subjects: Theories of Learning; Higher Education; International & Comparative Education

Keywords: approaches to learning; epistemological beliefs; factor analysis; Chinese students; higher education; social class

1. Introduction

This study addresses two concerns related to teaching at the Master's level. The first is that mainland Chinese students enrolled in UK undergraduate programmes have achieved lower than expected grades (Crawford & Wang, 2015; Iannelli & Huang, 2014). Given the substantial and increasing number of Chinese students in the UK study at Master's level, it is essential to investigate whether they also under-achieve in this context and, if so, why. Achievement data at Master's level are not available in national databases. We therefore accessed semester one grades at one UK Business School for Master's students enrolled in Accounting, Economics, Finance, Management, Marketing and Strategy programmes. Roughly half of all Chinese students on Masters programmes in the UK enrol on Business programmes (Iannelli & Huang, 2014) and in our sample 65.3% of students were mainland Chinese.

The second concern arises from the notion that, although some have suggested (e.g., Mistry et al., 2006) that Masters programmes should place greater emphasis on fostering students' agency as learners, there is a lack of empirical evidence to demonstrate the extent of its potential benefits. We therefore provide new evidence regarding these associations while controlling for numerous confounding effects, including personal and parental background.

We seek to bring together disparate results in the literature by combining, for the first time, five partially-overlapping empirical methodologies in three steps with the aim of modelling educational attainment. Our first step encompasses three methodologies: we collect primary data on students using the original, unaltered survey instruments (questionnaires) by Biggs (1987) on *approaches to learning* (AtL) and by Schommer (1990) on *epistemological beliefs* (EB), supplemented with individuals' demographic and academic data. Past research has sought to reduce the number of survey items (questions) either for its own sake or to focus on identifying "deep" and "surface" AtL (e.g. using *confirmatory factor analysis* in Biggs et al., 2001) but this has led to a plethora of results including the creation of new survey instruments. For instance, Tait and Entwistle (1996) created a 52 item *revised approaches to studying inventory*.[1] Our second step is to carry out an empirical *exploratory factor analysis* to identify AtL and EB factors for mainland Chinese and non-Chinese students and for the student group as a whole. Schommer (1990, 1998) originally carried out exploratory factor analysis on U.S. university students, college students, and later the general public, and consistently found the same four factors for EBs. Our third step spans two methodologies: we use multivariate ordinary least squares (OLS) regression to model academic outcomes (semester one grades) using the aforementioned derived AtL and EB factors while also including our demographic data.[2] Our multivariate analysis builds on the bivariate analysis of Tolhurst (2007) who identified positive associations between postgraduate grades and EBs based on the Schommer (1990) survey instrument. However, her bivariate analysis could not simultaneously control for various factors and demographic characteristics.[3] Our multivariate analysis also builds on the work of Crawford and Wang (2015) who used data from 112 Chinese and British students in BSc (honours) Accounting and Finance programmes to model academic progress based on nationality, gender, degree scheme, previous academic attainment and enrolment year, but did not consider factors derived from AtL and EBs.

We are mindful that our analysis does not aim to identify "Chineseness" as a characteristic, and inferences made from our results may only apply to this specific cohort of mainland Chinese students who attended these UK Master's courses. Our concern lies in the potential challenges faced by mainland Chinese students as they adapt to student life in Western countries, including unfamiliar teaching methods and expectations regarding their roles as learners (Quan et al., 2016). Crawford and Wang (2015) found that the achievement gap between Chinese and other students widened during undergraduate courses. One explanation (Sun & Richardson, 2012) was that Chinese students' learning approaches are less effective in a Western context.

The next section reviews previous research and is followed by sections describing our methods, results and offering some discussion and conclusions.

2. Background and literature

This section reviews the definitions of approaches to learning (AtL) and epistemological beliefs (EB) and their expected relationship to academic performance. The original qualitative evidence on AtL identified two distinctive approaches, deep and surface. Qualitative and quantitative research has reliably identified a "deep approach to learning", whilst some quantitative studies have found that a "surface approach" has fractured into sub-categories (Biggs, 1992; Kember & Gow, 1991; Willis, 1993). Other studies (e.g. Biggs, 1992; Samarakoon et al., 2013) have also claimed an "achieving" or "strategic" approach that focuses on matching study behaviour to the educational context. Finally, Leung et al. (2008) have suggested an "intermediate" approach that combines deep and surface approaches. Table 1 summarises suggested relationships between study behaviours and intentions.

Table 1. Study behaviours and intentions in learning				
Label	**Study behaviours**			**Intention**
	Rote learning	**Searching for meaning**	**Match to context**	
Surface	High	Low	Weak	Memorisation
Deep	Low	High	Weak	Understanding
Strategic/Achieving	Depends on context	Depends on context	Strong	Grade maximisation
Intermediate	High	High	Weak	Understanding

The effect of culture and education on AtL has also been widely studied from a quantitative perspective (e.g. Crawford & Wang, 2015; Kember & Gow, 1991; Leung et al., 2008; Sun & Richardson, 2012) with particular reference to Biggs's early work. Any interpretation of these comparisons has to take account of a number of factors that may influence students' approach to learning: (i) educational culture before university; (ii) adaptation to the teaching experienced at university; and (iii) uncertainty when adjusting to the educational experience in a different country. The study by Leung et al. (2008) controls for (iii) but not (ii), whilst the study by Sun and Richardson (2012) controls for (ii) but not (iii). Both studies provide valuable evidence about the experience of learning in particular contexts but neither controlled for (i).

Schommer (1990) found her 63 items combined into five factors[4] but subsequent use of her questionnaire by Chan and Elliott (2002)[5] and Cano (2005)[6] with Chinese students has suggested fewer factors. In contrast Hofer and Pintrich (1997) concentrated on beliefs about the nature of knowledge, combining certain/simple in one factor, to which they added justification for knowing, source of knowledge (authority) and attainment of truth. This variation in factors may arise from (i) choice of method of factor analysis (Preacher & MacCallum, 2003); (ii) variation in context for data collection (Chan & Elliott, 2002; Lin et al., 2013); or (iii) problems with the data collection instruments (Clarebout et al., 2001). Current evidence makes it difficult to apportion the variation between these three possible causes.

We might anticipate some relationship between AtL and either definition of EBs insofar as a surface approach to learning suggests a belief that knowledge can be grasped in certain, distinct "nuggets" whilst a deep approach to learning suggests that uncertainties and inter-relationships in knowledge have to be grappled with. Previous analyses of relationships between EBs and AtL (e.g. Cano, 2005; Chan, 2003; Tanriverdi, 2012) have used Schommer's epistemological beliefs questionnaire (EBQ) and variants of Biggs' study process questionnaire (SPQ) as research instruments. Although they report different factor structures for EBs, they have a consistent message: a surface AtL is associated with a belief that ability is innate and that knowledge is simple whilst a deep AtL is associated with learning that depends on effort.

The case for expecting AtL and EBs to affect educational attainment rests partly on theory. If gaining knowledge requires making contingent, justifiable, connections in an elaborate web of assumptions, propositions and facts, then believing that knowledge is simple, certain and readily amenable to rote-learning might lead to lower attainment. It also rests partly on evidence. Studies on students of different ages (e.g. Ongowo, 2022; Trautwein & Lüdtke, 2007) have reported positive associations between beliefs that knowledge is uncertain and student attainment. However, associations between other beliefs and course-level performance across disciplines have been found to be less certain (Aditomo, 2018; Chan & Elliott, 2000; Hofer, 2000; Jena & Chakraborty, 2018; Shirzad et al., 2022) and whether sophisticated beliefs are always advantageous across disciplines or tasks has been questioned by Yazbec et al. (2019).

Some studies have indicated that EBs are culture-specific (Chan & Elliott, 2004; Youn, 2000), with Chinese learners characterised as holding naïve EBs. This is often cited as the reason for their perceived relatively poor performance. Constructs relating to "Fixed ability" and "Certain knowledge" have consistently been extracted for mainland Chinese and Hong Kong students. "Innate ability", "Learning effort" and "Authority/Expert knowledge" are also consistent in student samples from China. However, these students have not always been found to exhibit naïve beliefs. For instance, Lee et al. (2013, p. 137) found " . . . that Chinese teachers are not inclined to believe that ability is innate and fixed, and that knowledge is certain and permanent". Teachers in these samples also seemed to believe that knowledge from authority should be questioned. Chan and Elliott (2002, p. 409) found that " . . . Hong Kong teacher-education students tended not to believe in Authority/Expert Knowledge and Certainty Knowledge". Furthermore, Chan and Elliott (2002, p. 409) state that "[t]here was a significant statistical difference in epistemological beliefs held by students in the Chinese and English courses. The students in the Chinese course tended to disagree more with the belief in Innate/Fixed Ability and Authority/Expert Knowledge than students in the English course". Finally, Zhu et al. (2008, p. 420) found that students in both China and Belgium held limited beliefs in "Certain knowledge" and "Fixed ability".

If EBs form part of, or influence wider metacognition, the way these associations influence metacognitive differences amongst different cultures and, in turn, academic performance should be further explored. EBs may also be related to age and educational level (Schommer, 1993) and this relationship should be further investigated. Furthermore, teachers who hold sophisticated EBs have also been found to hold constructivist conceptions of learning and teaching (Letina, 2022; Soleimani, 2020). Given this background, the present study aims to further explore the associations between EBs and academic performance at the Master's level.

In relation to AtL, the terms "Deep" and "Surface" have gained favour in the literature to describe dichotomous approaches to learning. However, the exact construct (and scales) of these approaches to learning vary across questionnaires, even if they measure the same AtL at a broad conceptual level (Richardson, 1994). A "super" form of the "Deep" approach has been suggested by Entwistle and McCune (2013, p. 1) who found evidence of " . . . a particular kind of thinking disposition that reveals itself within university . . . and appears to be a more consistent and stronger form of the 'intention to understand' found in the deep approach to learning". Entwistle & McCune sought to test whether there was evidence of students, originally identified by Ramsden (1979, p. 424), who stood out as being ". . .less negatively influenced by the course and departmental context". These students seemed less influenced by their perceptions of the teaching environment. Several studies have suggested a negative relationship between a surface AtL and student attainment (e.g. Diseth, 2007; Reid et al., 2007). The surface AtL has been characterised as a less desirable approach that presents itself in response to students' negative perceptions of the learning environment and course of study (Biggs, 1996, p. 52; Richardson, 1994). Ramsden and Entwistle (1981, p. 382) found that " . . . the approaches students adopt are to some extent shaped by the teaching, the assessment, and the course organisation". They therefore argue that university departments need to realise that they have " . . . responsibility for the efficiency of learning achieved by their students".

In contrast to the findings above, Kember and Danping (2016, p. 11) has argued that intermediate approaches to learning can actually lead to superior performance by East-Asian secondary-school students, especially in mathematics. Kember suggested that memorising might lead to superior performance in assessments because of the inevitable need to recall information that has been understood. Empirical evidence for the effectiveness of this intermediate approach in mathematics, among secondary-school students in seven Asian countries, was provided by Wu et al. (2020). They used latent class analysis, on data from 15-year old respondents of the Programme for International Student Assessment (PISA) survey, to compare four learning strategies that combined metacognition, memorisation and elaboration. Among these four, Wu et al. found that

a "metacognition with memorization" was the most widely used (50.7%) and, along with "meta-cognition with elaboration", was associated with higher mathematics achievement.

The present study uses factor analysis to shed light on the presence of these intermediate learning approaches among MSc-level students, and whether memorising emerges as a superior general learning strategy.

3. Method

This paper uses quantitative analyses to examine relationships between AtL, EBs and grades achieved by students. It compares mainland Chinese and non-Chinese students using a sample of students enrolled on Master's courses in the Business School of one UK university. It addresses two research questions:

RQ1: How are AtL related to EBs and are relationships between these two constructs the same for Chinese and non-Chinese students?

RQ2: Is there a discernible association between espoused AtL and/or EBs and grades achieved after one semester of Master's level teaching? Are associations the same for Chinese and non-Chinese students?

To answer RQ1, we examined correlations between factors in AtL and EBs. To answer RQ2, we used multivariate OLS regression to estimate associations between AtL and EBs with a weighted mean-average of Semester 1 grades for summative assessment.

3.1. Approach, design and sampling strategy

One UK Business School was selected for surveying students, given the perceived high proportion of students from mainland China in the sector. The proportion of students from mainland China was 65.3%, exceeding the hoped-for 50%. Another criterion was to collect data early in the academic year to minimise the impact of other influencing factors such as changing attitudes towards AtL and EBs. Data on AtL and EBs were collected early in the Master's programme using a paper questionnaire administered during a core lecture in the third day of welcome week, at the start of the academic year.

Another aspect of the research design was to achieve a near-full response rate to avoid sample selection issues and minimise the attrition due to non-responses within the survey. Another reason for selecting welcome week is that student attendance and compliance tend to be high in this period. Even with access to administrative data, it is hard to determine the true total number of students because some students do not turn up while others leave. Including the no-show students, the total number was approximately 615. The paper questionnaire was completed by 485 students during the core lecture in welcome week. Thereafter, official student records were used to identify non-responders. These students were asked to complete an equivalent online questionnaire within one week, and a further 79 students did so. Students' grades were collected using administrative data at the end of the first semester to limit the transformative effect of attending a Western education institution.

3.2. The data collection instruments and factor analyses

We used Biggs's (1987) original 42-item SPQ to gather data on AtL and, following Chan and Elliott (2002) and Cano (2005), we used Schommer's (1990) 63-item EBQ to gather data on EBs. In each case we conducted three analyses: all students, Chinese students and non-Chinese students.[7] Separating analyses of Chinese and non-Chinese students enabled a comparison of the factor structure for the two groups. In the light of arguments about choice of analytical method (e.g. Preacher & MacCallum, 2003) we conducted Maximum Likelihood factor analyses, first using Direct Oblimin and, if convergence failed, by Varimax rotation. Items (questions) with loadings smaller than ± 0.40 were omitted from each factor. Our intention was to check the structure of our data when compared with previous research. Given the evidence from previous studies we specified initial two-factor structures for AtL and three-factor structures for EBs.

3.3. Factor analysis results for Approaches to Learning (AtL)

Factor analysis results for the AtL in Table 2 show factor loads broadly in line with previous studies, with "surface" items loading on to one factor and "deep/achieving" items loading on to the other. The factor analysis resulted in two factor variables for each student sample: full, Chinese, non-Chinese. Each pair of factor variables, "deep/achieving" and "surface", will be included among the explanatory variables in the regression models of academic achievement reported in the Results section. Among the 42 survey items (questions) with factor loads smaller than ± 0.40, items 7, 21, 31, 38 and 39 did not load onto any factors for any group of students. There seems to be no obvious common link between these five items.

3.4. Factor results for Epistemological Beliefs (EB)

Factor analysis results for the EBs are reported in Table 3. Direct Oblimin was again initially used for the factor analysis but for the full sample and non-Chinese sub-samples Varimax rotation was used to achieve convergence. Among the 63 survey items with factor loads smaller than ± 0.40, just nine items did not load onto any factors: 5, 8, 9, 20, 22, 29, 41. 42 and 57. As was the case for the non-loading AtL items, there seems to be no obvious common pattern among the non-loading EB items.

Using Schommer's (1990) "control of learning" as a reference point we refer to the first factor for each student group as "learner agency". The second factor combines Schommer's "speed of learning" and "organisation of knowledge" (which we refer to as "quick and simple"). This second factor includes items which appear to focus on beliefs about knowledge and items focusing on beliefs about learning, perhaps suggesting a difficulty in disentangling the two. Our third factor combines Schommer's "certainty of knowledge" and "source of knowledge" in the same way as reported by Cano (2005). We refer to this factor as "certain/authority". The only caveat in these results is that for the Chinese sub-sample the factor analysis did not distinguish between "quick and simple" and "certain knowledge" and they were therefore combined into a single factor "certain, simple, innate" as summarised in Table 3. Just one question had a large, negative (−0.49) factor loading and, intriguingly, this was for the non-Chinese sub-sample: "Often, even advice from experts should be questioned". The negative factor loading is interpreted as reversing this question statement to become "Advice from experts should NOT be questioned".

As we have seen, construction of the factors can be complex but, we will see in the next sub-section, that their inclusion in the regression analysis is straightforward and provides insights into how AtL and EBs affect the grades students achieve.

3.5. The regression analysis

A preliminary analysis of the data highlighted high correlations between AtL and EB factors, see Table 5. Hence, to mitigate issues of regression collinearity between these factors, we included AtL and EBs in separate OLS regression models:

$$G_i = \beta_0 + \beta_1 AtL_i + \beta_2 SC_i + \beta_3 UE_i + \beta_4 MP_i + \beta_5 IV(GPA)_i + e_i$$

$$G_i = \beta_0 + \beta_1 EB_i + \beta_2 SC_i + \beta_3 UE_i + \beta_4 MP_i + \beta_5 IV(GPA)_i + e_i$$

where, for each individual student *i*:

- G_i is the mean-average semester 1 grade awarded (75% of module grade from a three-hour written examination with remainder from projects or classroom tests),
- AtL_i is a vector of two approaches to learning,
- EB_i is a vector of three epistemological beliefs (two EBs for Chinese students),
- SC_i is a vector of student characteristics including nationality, gender, parental education and employment,

Table 2. Factor analysis for Biggs's SPQ "approaches to learning"

Student sample: Possible approach:	Joint sample		Chinese		Non-Chinese	
	Deep/achieving	Surface	Deep/achieving	Surface	Deep/achieving	Surface
Overall Cronbach alphas for each factor's loadings:	.92	.57	.93	.67	.89	.60
Likert-scale answers[†] applied to these questions:			Individual factor loadings[††]			
1. I chose my present courses largely with a view to the job situation when I graduate, rather than out of their intrinsic interest to me. when I graduate, rather than out of their intrinsic interest to me.	.22	.31	.24	.22	.09	.41
2. I find that at times studying gives me a feeling of deep personal satisfaction. satisfaction.	.51	-.04	.47	-.01	.58	-.01
3. 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. to select from among the best positions available when I graduate.	.48	.16	.53	.04	.42	.09
4. I think browsing around is a waste of time, so I only study seriously what's given out in class or in the course outlines.	-.04	.40	-.08	.50	-.03	.24
5. While I am studying, I often think of real-life situations to which the material that I am learning would be useful. the material that I am learning would be useful.	.59	.00	.57	-.08	.56	-.05
6. I summarize suggested readings and include these as part of my notes on a topic. notes on a topic.	.58	.04	.56	-.03	.54	.06
7. I am discouraged by a poor mark on a test and worry about how I will do on the next text. will do on the next text.	.04	.39	.03	.36	-.02	.36

(Continued)

Table 2. (Continued)

Student sample:	Joint sample		Chinese		Non-Chinese	
Possible approach:	Deep/ achieving	Surface	Deep/ achieving	Surface	Deep/ achieving	Surface
8 While I realise that truth is forever changing as knowledge is increasing, I feel compelled to discover what appears to be the truth at this time *increasing, I feel compelled to discover what appears to be the truth at this time*	.44	.17	.31	.25	.42	.14
9 I have a strong desire to excel in all my studies.	.62	.17	.60	.08	.52	.04
10 †††I learn some things by rote, going over and over them until I know them by heart. *know them by heart.*	.48	.23	.51	.04	.32	.30
11 In reading new material I often find that I'm continually reminded of material I already know and sec the latter in a new light (D). *of material I already know and sec the latter in a new light (D).*	.58	.07	.58	.00	.57	.02
12 I try to work consistently throughout the term and review regularly when the exams are close. *regularly when the exams are close.*	.57	.07	.60	-.11	.58	.18
13 †††Whether I like it or not, I can see that further education is for me a good way to get a well-paid or secure job. *me a good way to get a well-paid or secure job.*	.48	.19	.47	.06	.44	.21
14 I feel that virtually any topic can be highly interesting once I get into it. *into it.*	.52	.21	.59	.01	.40	.31
15 I would see myself basically as an ambitious person and want to get to the top, whatever I do. *get to the top, whatever I do.*	.61	.16	.62	.05	.52	.03

(Continued)

Table 2. (Continued)

Student sample:	Joint sample		Chinese		Non-Chinese	
Possible approach:	*Deep/ achieving*	*Surface*	*Deep/ achieving*	*Surface*	*Deep/ achieving*	*Surface*
16 †††I tend to choose subjects with a lot of factual content rather than theoretical kinds of subjects. *than theoretical kinds of subjects.*	.34	.23	.41	.13	.16	.17
17 I find that I have to do enough work on a topic so that I can for many own point of view before I am satisfied. any own point of view before I am satisfied.	.58	.12	.61	-.03	.57	.25
18 I try to do all of my assignments as soon as possible after they are given out. given out.	.46	.17	.47	-.07	.46	.46
19 Even when I have studied hard for a test, I worry that I may not be able to do well in it. able to do well in it.	.18	.40	.26	.31	-.03	.34
20 I find that studying academic topics can at times be as exciting as a good novel or movie. a good novel or movie.	.50	.06	.51	-.02	.48	-.03
21 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. popularity with my fellow students for success in my studies and subsequent career.	.37	.19	.37	.11	.27	.31
22 I generally restrict any study to what is specifically set as I think it is unnecessary to do anything extra. is unnecessary to do anything extra.	-.14	.54	-.09	.56	-.32	.46
23 I try to relate what I have learned in one subject to that in another. another.	.66	-.03	.66	-.14	.63	-.15

(Continued)

Table 2. (Continued)

Student sample:	Joint sample		Chinese		Non-Chinese	
Possible approach:	Deep/achieving	Surface	Deep/achieving	Surface	Deep/achieving	Surface
24 After a lecture or lab I reread my notes to make sure they are legible and that I understand them. legible and that I understand them.	.49	.13	.59	–.13	.45	.30
25 Lecturers shouldn't expect students to spend significant amounts of time studying material everyone knows won't be examined. of time studying material everyone knows won't be examined.	–.08	.52	–.09	.64	–.23	.36
26 I usually become increasingly absorbed in my work the more I do.	.54	.09	.53	.09	.55	–.02
27 †††One of the most important considerations in choosing a course is whether or not I will be able to get top marks in it. *is whether or not I will be able to get top marks in it.*	.11	.60	.12	.52	–.7	.56
28 I learn best from lecturers who work from carefully prepared notes and outline major points neatly on the board. notes and outline major points neatly on the board.	.46	.21	.53	.01	.34	.23
29 I find most new topics interesting and often spend extra time trying to obtain more information about them. trying to obtain more information about them.	.58	.01	.59	–.12	.60	.06
30 I test myself on important topics until I understand them completely. completely.	.66	.05	.65	–.12	.63	.07
31 I almost resent having to spend a further three or four years studying after learning at school, but feel that the end results will make it all worthwhile. studying after learning at school, but feel that the end results will make it all worthwhile.	.30	.30	.39	.20	.13	.31

(Continued)

Table 2. (Continued)

Student sample:	Joint sample		Chinese		Non-Chinese	
Possible approach:	Deep/ achieving	Surface	Deep/ achieving	Surface	Deep/ achieving	Surface
32 I believe strongly that my main aim in life is to discover my own philosophy and belief system and to act strictly in accordance with it. philosophy and belief system and to act strictly in accordance with it.	.44	.17	.52	.04	.31	.18
33 I see getting high grades as a kind of competitive game, and I play it to win. it to win.	.42	.31	.48	.20	.24	.31
34 I find it best to accept the statements and ideas of my lecturers and question them only under special circumstances. and question them only under special circumstances.	.14	.44	.36	.25	-.19	.49
35 I spend a lot of any free time finding out more about interesting topics which have been discussed in different classes. topics which have been discussed in different classes.	.42	.10	.45	.07	.39	-.01
36 I make a point of looking at most of the suggested readings that go with the lecturers. go with the lecturers.	.59	.16	.59	.08	.57	.14
37 I am at college/university mainly because I feel that I will be able to obtain a better job if I have a tertiary qualification. to obtain a better job if I have a tertiary qualification.	.34	.31	.42	.14	.15	.40
38 My studies have changed my views about such things as politics, my religion, and my philosophy of life. my religion, and my philosophy of life.	.34	.03	.36	.00	.31	-.04
39 I believe that society is based on competition and school: and universities should reflect this. universities should reflect this.	.27	.27	.36	.14	.17	.30

(Continued)

Table 2. (Continued)

Student sample:	Possible approach:	Joint sample		Chinese		Non-Chinese	
		Deep/ achieving	*Surface*	*Deep/ achieving*	*Surface*	*Deep/ achieving*	*Surface*
40	I am very aware that lecturers know a lot more than I do and so I concentrate on what they say is important rather than rely on my own judgment. concentrate on what they say is important rather than rely on my own judgment.	.19	.39	.17	.41	.16	.26
41	I try to relate new material, as I am reading it, to what I already know on that topic. know on that topic.	.65	−.06	.64	−.16	.62	−.09
42	I keep neat, well-organised notes for most subjects.	.51	.13	.59	−.09	.46	.24

Notes: †Possible answers: Never/Sometimes/Half the time/Frequently/Always true.

††Factor loadings based on Direct Oblimin factor analysis. Items with loadings smaller than ±0.40 are omitted.

†††Unexpected factor loadings indicated by items in italics.

Table 3. Factor analysis for Schommer's EBQ "epistemological beliefs"

Student sample:	Joint sample			Chinese		Non-Chinese		
Possible belief:	Learner agency	Simple/innate	Certain/authority	Learner agency	Certain, simple, innate	Learner agency	Simple, innate	Certain/authority
Overall Cronbach alphas for each factor's loadings:	.89	.78	.69	.90	.85	.88	.77	.75
Likert-scale answers[†] applied to these questions:				Individual factor loadings[††]				
1 If you are ever going to be able to understand something, it will make sense to you the first time you hear it. something, it will make sense to you the first time you hear it.	.18	.42	-.04	.34	.05	.02	.42	.13
2 The only thing that is certain is uncertainty itself.	.36	.32	-.16	.46	-.07	.23	.32	-.03
3 For success in school, it's best not to ask too many questions questions	-.11	.33	.44	-.15	.64	-.14	.31	.32
4 A course in study skills would probably be valuable	.44	.04	.15	.43	.02	.48	.00	.26
5 How much a person gets out of school mostly depends on the quality of the teacher on the quality of the teacher	.18	.11	.36	.19	.39	.06	.15	.23
6 You can believe almost everything you read	-.07	.25	.51	-.12	.58	-.10	.29	.39
7 I often wonder how much my teachers really know	.11	.25	.29	.09	.37	.04	.51	.06
8 The ability to learn is innate	.14	.18	.25	.07	.36	.19	.12	.22
9 It is annoying to listen to a lecturer who cannot seem to make up his mind as to what he really believes. to make up his mind as to what he really believes.	.29	.27	.04	.31	.12	.20	.29	.15
10 Successful students understand things quickly	.10	.44	.05	.23	.22	-.06	.57	-.05
11 A good teacher's job is to keep his students from wandering from the right track wandering from the right track	.36	.22	.09	.46	-.01	.26	.16	.36
12 If scientists try hard enough, they can find the truth to almost everything almost everything	.15	.01	.43	.04	.48	.19	.15	.08

(Continued)

Table 3. (Continued)

Student sample: Possible belief:	Joint sample			Chinese		Non-Chinese		
	Learner agency	Simple/innate	Certain/authority	Learner agency	Certain, simple, innate	Learner agency	Simple, innate	Certain/authority
13 People who challenge authority are over-confident	-.01	.21	.44	-.07	.57	.04	.04	.46
14 I try my best to combine information across chapters or even across classes even across classes	.52	-.12	.01	.48	-.06	.59	-.16	-.10
15 The most successful people have discovered how to improve their ability to learn improve their ability to learn	.58	.13	.02	.61	-.04	.55	.00	.26
16 Things are simpler than most professors would have you believe you believe	.20	.31	.27	.24	.28	.12	.40	.42
17 The most important aspect of scientific work is precise measurement and careful work. measurement and careful work.	.47	.11	.19	.45	.12	.49	.09	.28
18 To me studying means getting the big ideas from the text, rather than details text, rather than details	.06	.25	.30	.02	.48	.04	.43	.07
19 Educators should know by now which is the best method, lectures or small group discussions method, lectures or small group discussions	.37	.33	.10	.46	.12	.29	.33	.29
20 Going over and over a difficult textbook chapter usually won't help you understand it. won't help you understand it.	.03	.22	.23	-.03	.33	.06	.27	.25
21 Scientists can ultimately get to the truth	.18	.07	.41	.06	.48	.30	.12	.02
22 You never know what a book means unless you know the intent of the author. the intent of the author.	.21	.19	.17	.24	.25	.15	.33	.04
23 The most important part of scientific work is originalthinking thinking	.45	.14	.07	.44	.11	.51	.15	-.01

(Continued)

Table 3. (Continued)

Student sample:	Joint sample			Chinese		Non-Chinese		
Possible belief:	Learner agency	Simple/ innate	Certain/ authority	Learner agency	Certain, simple, innate	Learner agency	Simple, innate	Certain/ authority
24	If I find the time to re-read a textbook chapter, I get alot more out of it the second time / lot more out of it the second time	.54	.04	-.12	.56	-.14	.52	.02	-.11
25	Students have a lot of control over how much they can get out of a textbook / get out of a textbook	.50	-.17	.20	.45	.11	.54	-.19	-.09
26	Genius is 10% ability and 90% hard work	.38	-.13	.19	.31	.06	.44	-.22	.17
27	I find it refreshing to think about issues that authorities can't agree on / can't agree on	.42	.01	.15	.38	.13	.41	.12	-.08
28	Everyone needs to learn how to learn	.63	.09	-.07	.65	-.20	.67	.09	.11
29	When you first encounter a difficult concept in a textbook, it's best to work it out on your own. textbook, it's best to work it out on your own.	.27	.17	.04	.31	.06	.17	.29	-.04
30	A sentence has little meaning unless you know the situation in which it is spoken situation in which it is spoken	.58	.05	-.09	.61	-.16	.51	.17	-.12
31	Being a good student generally involves memorizing facts	.24	.40	.10	.37	.15	.10	.37	.26
32	Wisdom is not knowing the answers, but knowing how to find the answers to find the answers	.70	.08	-.22	.74	-.30	.68	.08	-.08
33	Most words have one clear meaning	.04	.33	.35	.06	.43	-.03	.20	.49
34	Truth is unchanging	-.02	.14	.54	-.07	.52	-.06	.01	.65

(Continued)

Table 3. (Continued)

Student sample: Possible belief:	Joint sample:			Chinese		Non-Chinese		
	Learner agency	Simple/ innate	Certain/ authority	Learner agency	Certain, simple, innate	Learner agency	Simple, innate	Certain/ authority
35 If a person forgot details, and yet was able to come up with new ideas from a text, I would think they were very bright with new ideas from a text, I would think they were very bright	.44	−.14	.20	.35	.11	.54	−.05	−.02
36 Whenever I encounter a difficult problem in life, I consult with my parents consult with my parents	.07	−.06	.43	−.06	.41	.18	−.07	.26
37 Learning definitions word-for-word is often necessary to do well on tests to do well on tests	.22	.22	.28	.23	.29	.18	.12	.43
38 When I study, I look for the specific facts	.49	.11	.12	.52	.06	.45	.10	.12
39 If a person can't understand something within a short amount of time, they should keep on trying amount of time, they should keep on trying	.56	−.03	.12	.62	.03	.44	−.08	.03
40 Sometimes you just have to accept answers from a teacher even though you don't understand them teacher even though you don't understand them	−.03	.41	.37	.01	.54	−.14	.33	.39
41 If professors would stick more to the facts and do less theorizing, one could get more out of college. theorizing, one could get more out of college.	.18	.32	.23	.21	.31	.12	.34	.28
42 I don't like movies that don't have an ending	.06	.07	.39	.04	.38	.06	.08	.36
43 Getting ahead takes a lot of work	.50	−.05	.14	.49	.04	.50	−.12	.04
44 It's a waste of time to work on problems which have no possibility of coming out with a clear-cut and unambiguous answer possibility of coming out with a clear-cut and unambiguous answer	−.10	.29	.42	−.10	.50	−.16	.29	.50

(Continued)

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Table 3. (Continued)

	Student sample:	Joint sample			Chinese		Non-Chinese		
	Possible belief:	Learner agency	Simple/ innate	Certain/ authority	Learner agency	Certain, simple, innate	Learner agency	Simple, innate	Certain/ authority
45	You should evaluate the accuracy of information in a textbook, if you are familiar with the topic textbook, if you are familiar with the topic	.48	.04	.07	.49	.03	.46	.17	−.12
46	†††Often, even advice from experts should be questioned questioned	.49	−.01	−.10	.55	−.10	.38	.18	−.49
47	Some people are born good learners, others are just stuck with limited ability stuck with limited ability	.09	.44	.11	.19	.29	−.12	.49	.06
48	Nothing is certain, but death and taxes	.31	.18	−.04	.40	.01	.18	.24	−.10
49	The really smart students don't have to work hard to do well in school well in school	−.11	.40	.21	−.03	.46	−.31	.37	.11
50	Working hard on a difficult problem for an extended period of time only pays off for really smart students period of time only pays off for really smart students	−.14	.51	.29	−.06	.51	−.31	.42	.45
51	If a person tries too hard to understand a problem, they will most unlikely end up being confused will most unlikely end up being confused	.00	.52	.15	.16	.33	−.22	.51	.36
52	Almost all the information you can learn from a textbook you will get during the first reading textbook you will get during the first reading	−.02	.45	.33	.01	.51	−.10	.52	.30
53	Usually you can figure out difficult concepts if you eliminate all outside distractions and reallyconcentrate eliminate all outside distractions and really concentrate	.54	.03	.11	.52	.05	.54	.05	.00

(Continued)

Table 3. (Continued)

Student sample:	Possible belief:	Joint sample			Chinese		Non-Chinese		
		Learner agency	*Simple/ innate*	*Certain/ authority*	*Learner agency*	*Certain, simple, innate*	*Learner agency*	*Simple, innate*	*Certain/ authority*
54	A really good way to understand a textbook is to re-organize the information according to your own personal scheme re-organize the information according to your own personal scheme	.55	.03	.04	.57	.02	.52	-.08	-.01
55	Students who are average in school remain average for the rest of their lives the rest of their lives	-.18	.41	.27	-.17	.51	-.19	.45	.20
56	A tidy mind is an empty mind	-.02	.43	.20	.10	.42	-.22	.34	.16
57	An expert is someone who has a special gift in somearea area	.13	.37	.13	.28	.24	.01	.33	.19
58	I really appreciate instructors who organize their lectures meticulously and then stick to their plan lectures meticulously and then stick to their plan	.46	.11	.04	.64	-.07	.14	-.09	.25
59	The best thing about science courses is that most problems have only one right answer problems have only one right answer	.04	.17	.37	.01	.47	-.02	.13	.24
60	Learning is a slow process of building up knowledge	.41	.02	.04	.47	-.07	.30	-.07	.10
61	Today's facts may be tomorrow's fiction	.50	-.01	-.13	.61	-.24	.35	-.04	-.10
62	Self-help books are not much help	-.05	.16	.29	-.06	.41	-.13	.02	.28
63	You will just get confused if you try to integrate new ideas in a textbook with knowledge you already have about a topic ideas in a textbook with knowledge you already have about a topic‡*	-‡.08	.52	.17	.07	.40	-.30	.26	.42

Notes: *Possible answers: Strongly Disagree/Disagree/Neither Agree nor Disagree/Agree/Strongly Agree.

†Factor loadings based on Varimax rotation for Joint and non-Chinese sub-samples and Direct Oblimin for Chinese sub-sample. Items with loadings smaller than ± 0.40 are omitted.

‡Unexpected (negative) factor loadings indicated by item in italics.

- UE_i is a vector of undergraduate study experience, including whether they had to write a dissertation and the word length of essays they wrote (4-point scale),
- MP_i is a vector of categorical variables indicating the Master's programme (Accounting, Economics, Finance, Management, Strategy),
- $IV(GPA_i)$ is an instrumented variable estimating students' undergraduate attainment in terms of their grade point average and
- e_i is the OLS regression residual.

The factor scores for the AtL and EBs vectors were produced using the Anderson and Rubin (1956) method. These factor-scores were re-normalised to a mean of zero and a standard deviation of one, using the sample of students who answered every single survey question. This normalisation allows us to interpret the estimated regression coefficients as the association between a one-standard-deviation in the factor-score and each percentage point achieved in module grades. Another advantage is that, given the factor-scores are centred on zero, we could include any student not in the factor-group (e.g. non-Chinese) by simply assigning them a value of zero.

Parental employment data were collected by asking students to indicate which of six occupation types (with examples) best reflected father's and mother's employment. We used these data to create zero-one dummy variables, taking the value of 1 for blue collar or lower professional occupations. This choice of employment was guided principally by the significance of each employment category when all six were simultaneously allowed for in a regression. Our main purpose was to avoid attributing explanatory power to AtL or EBs that could be attributed to parental employment.

Our initial ethical approval did not include permission to directly link our survey data to individual students' Grade Point Average (GPA) scores for undergraduate university admission. However, upon ethics re-application we were permitted to use an indirect approach, similar to Instrumental Variable (IV) estimation, in our regression models. We modelled GPA as a function of all data available in the GPA dataset and fitted IV(UG-GPA%) scores were then linked to each student by means of anonymous student identifiers in our regression models. The instrumenting regression included GPA as a dependent variable and included as regressors gender (insignificant), 32 country of residence dummies and 29 programme of study dummies resulting in an OLS regression with 443 individuals, $R^2 = 25.78\%$ and cov(GPA%, IV(UG-GPA%)) = 0.5078. On average each programme shared modules with four other programmes. This degree of overlap means that differences in module grades by programme substantially reflect differences in entry thresholds.

Descriptive statistics for the sample data are provided in Table 4.

4. Results

4.1. Associations between approaches to learning and epistemological beliefs (RQ1)
Table 5 shows that correlation patterns between AtL and EB factors are similar for Chinese and non-Chinese students. A deep/achieving approach to learning is correlated with learner agency and a belief that knowledge is certain is correlated with a surface approach. However, for Chinese students only a belief that knowledge is simple and learning is quick was correlated with a deep approach to learning. These high correlations preclude including both AtL and EBs in the same regression in order to avoid collinearity in the models.

4.2. Regression analysis on approaches to learning and epistemological beliefs (RQ2)
Tables 6 and 7 report OLS regression estimates for models of academic achievement as a function of students' factor-scores for approaches to learning or epistemological beliefs and other demographic and academic characteristics.

Table 4. Descriptive statistics		
	Obs.	**Positive response %**
Students providing complete set of responses on approaches to learning*	423	
Students providing complete set of responses on epistemological beliefs*	381	
Gender	328	
Male		31.4
Female		68.6
Country of domicile	320	
Chinese		65.3
UK		7.5
Other European		4.7
Indonesian		7.2
Thai		4.4
Indian		1.6
Taiwan		2.2
Other		7.2
Graduate father	328	65.9
Graduate mother	328	51.5
Blue collar or lower professional father	308	15.6
Blue collar or lower professional mother	312	2.2
UG Essays: words > 3000	306	36.3
Wrote UG Dissertation	326	73.9
Subject area of study	328	
Accounting		1.0
Economics		1.2
Finance		16.7
Management		23.9
Marketing		18.3
Strategy		21.0
Dependent variable:	Mean:	s.d.
Each student's mean semester 1 mark (564 obs.)	64.3	7.8
Mean number of modules per student (1929 ÷ 564=)	3.42	

Notes: *Total survey sample 564.

Once all regression control variables for the "joint" sample are included (see Table 6, columns 5 and 6), only the "Learner agency" and "Quick & simple" factors achieve 5% statistical significance against their coefficients being zero. A one standard deviation in learner agency EB is associated with a 1.18% higher mean module grade. Belief that knowledge is simple and learning is quick is negatively associated with module grade to a similar extent. Turning to Table 7 we see that there is no association between AtL and module grades for either Chinese or non-Chinese students. The positive association between learner agency and module grades is only applicable to Chinese students whilst the negative association between a belief that knowledge is quick and simple and module grades is only applicable to non-Chinese students.

Table 5. Correlations between approaches to learning and epistemological beliefs

Chinese Sample		Approaches to learning			Epistemological beliefs	
		Deep/achieving	Surface	Learner agency		Certain, simple, innate
Approaches to learning	Deep/achieving	1.00				
	Surface	−0.00 (0.98)	1.00			
Epistemo-logical beliefs	Learner agency	0.53 (<0.001)	0.05 (0.49)	1.00		
	Certain, simple, innate	0.23 (<0.001)	0.47 (<0.001)	0.05 (0.41)		1.00

Non-Chinese Sample		Approaches to learning			Epistemological beliefs	
		Deep/achieving	Surface	Learner agency	Quick and simple	Certain/authority
Approaches to learning	Deep/achieving	1.00				
	Surface	−0.01 (.87)	1.00			
Epistemo-logical beliefs	Learner agency	0.58 (<0.001)	−0.10 (0.32)	1.00		
	Quick and simple	−0.11 (0.25)	0.18 (0.06)	0.05 (0.54)	1.00	
	Certain/authority	0.00 (0.99)	0.45 (<0.001)	−0.05 (0.58)	0.01 (0.92)	1.00

Notes: Figures in parentheses show the *p*-value. After a Bonferroni correction the *p*-value required for significance at 1% is 0.002 and at 5% it is 0.01.

Table 6. OLS regression models with joint Chinese/non-Chinese factors

Regressand:

Semester one compulsory mean module grade

Model:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Approaches to learning:						
(Joint) Deep/achieving	0.12		−0.26		−0.30	
	(0.31)		(−0.58)		(−0.75)	
(Joint) Surface	−1.01***		−0.88**		−0.64*	
	(−2.61)		(−2.05)		(−1.69)	
Epistemological beliefs:						
(Joint) Learner agency		1.37***		1.41***		1.18***
		(3.57)		(3.19)		(3.01)
(Joint) Quick & simple		−1.03***		−0.87*		−0.96**
		(−2.70)		(−1.69)		(−2.11)
(Joint) Certain/authority		−0.61		−0.53		−0.48
		(−1.59)		(−1.27)		(−1.29)
Chinese student			−3.00***	−1.98*	−3.23***	−2.07**
			(−2.89)	(−1.74)	(−3.52)	(−2.06)
Male			1.33	1.34	0.47	0.79
			(1.32)	(1.35)	(0.52)	(0.91)
UG Essays: ave.words >3000			1.22	0.50	0.77	0.11
			(1.31)	(0.53)	(0.93)	(0.14)
UG Dissertation?			2.51**	3.17***	1.04	1.63*
			(2.47)	(3.17)	(1.12)	(1.80)
IV(UG-GPA%)			0.22	0.34*	0.52***	0.56***
			(1.13)	(1.73)	(2.88)	(3.17)
Graduate mother			−0.88	−0.72	−0.34	0.04

(Continued)

Table 6. (Continued)

Regressand:	Semester one compulsory mean module grade					
Model:	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
			(−0.84)	(−0.69)	(−0.36)	(0.04)
Graduate father			−0.55	−0.66	−1.05	−1.19
			(−0.49)	(−0.60)	(−1.06)	(−1.24)
Blue collar or lower professional father			3.42**	3.33**	3.16**	2.89**
			(2.36)	(2.17)	(2.46)	(2.11)
Blue collar or lower professional mother			−1.81	−1.66	−2.10*	−1.79
			(−1.39)	(−1.27)	(−1.82)	(−1.55)
Subject area of study (Marketing is the reference subject area)						
Accounting					4.48***	4.83***
					(3.06)	(3.23)
Economics					13.20***	12.63***
					(8.80)	(8.02)
Finance					6.62***	7.74***
					(5.17)	(6.14)
Management					2.66**	2.52**
					(2.11)	(2.04)
Strategy					7.03***	6.45***
					(5.47)	(5.18)
Constant	63.83***	63.95***	45.20***	34.62**	16.89	11.82
	(165.60)	(167.84)	(2.67)	(2.07)	(1.10)	(0.78)
Observations	423	381	313	285	313	285
R^2	0.016	0.053	0.109	0.158	0.322	0.362

Notes: Models (1) and (2) are the simplest specifications, (3) and (4) add demographics, (5) and (6) add study subject-areas.

Models (1), (3) and (5) include approaches to learning, and models (2), (4), and (6) include epistemological beliefs.

t statistics in parentheses, *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

†64.7% Chinese, (5.5% British, 5.4% other European, 5.6% Indonesian, 4% Thai, 2.2% Indian, 2.2% Taiwanese, 10.4% other non-Chinese, 0% Hong Kong).

Table 7. OLS regression models with separate Chinese/non-Chinese factors						
Regressand:	**Semester one compulsory mean module grade**					
Model:	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Approaches to learning:						
(Chinese) deep/achieving	−0.46		−0.73		−0.41	
	(−0.95)		(−1.43)		(−0.89)	
(Chinese) surface	−0.43		−0.47		−0.36	
	(−0.89)		(−0.90)		(−0.76)	
(Non-Chinese) deep/achieving	0.91		0.94		−0.01	
	(1.37)		(1.13)		(−0.01)	
(Non-Chinese) surface	−1.51**		−0.94		−0.82	
	(−2.28)		(−1.21)		(−1.18)	
Epistemological beliefs:						
(Chinese) learner agency		1.16**		1.13**		1.11**
		(2.43)		(2.25)		(2.48)
(Chinese) certain, simple,		−0.90*		−0.71		−0.64
Innate		(−1.89)		(−1.42)		(−1.47)
(Non-Chinese) learner agency		1.84***		1.66*		0.86
		(2.79)		(1.90)		(1.12)
(Non-Chinese) simple, innate		−1.19*		−0.63		−0.44
		(−1.80)		(−0.72)		(−0.57)
(Non-Chinese) certain/authority		−0.96		−1.39*		−1.90***
		(−1.45)		(−1.76)		(−2.75)
Chinese student			−2.95***	−2.79***	−3.13***	−3.06***
			(−2.87)	(−2.75)	(−3.45)	(−3.43)
Male			1.28	1.37	0.39	0.85
			(1.26)	(1.39)	(0.43)	(0.98)
UG Essays: av. words > 3000			1.20	0.62	0.76	0.34
			(1.28)	(0.65)	(0.91)	(0.40)
UG Dissertation?			2.36**	3.33***	1.09	1.82**
			(2.29)	(3.29)	(1.15)	(2.01)
IV(UG-GPA%)			0.19	0.34*	0.50***	0.61***
			(0.95)	(1.73)	(2.73)	(3.37)
Graduate mother			−0.75	−0.75	−0.30	−0.10
			(−0.71)	(−0.70)	(−0.32)	(−0.11)
Graduate father			−0.50	−0.52	−1.04	−0.99
			(−0.44)	(−0.47)	(−1.05)	(−1.02)
Blue collar or lower			3.62**	3.26**	3.24**	2.90**
professional father			(2.48)	(2.11)	(2.50)	(2.11)
Blue collar or lower			−1.74	−1.59	−2.10*	−1.89
professional mother			(−1.33)	(−1.20)	(−1.80)	(−1.62)
Subject area of study (Marketing is the reference subject area)						
Accounting					4.56***	5.17***
					(3.08)	(3.43)
Economics					13.18***	13.06***
					(8.66)	(8.20)

(Continued)

Regressand:	Semester one compulsory mean module grade					
Model:	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Finance					6.65***	7.77***
					(5.16)	(6.19)
Management					2.71**	2.64**
					(2.14)	(2.14)
Strategy					7.14***	6.61***
					(5.40)	(5.30)
Constant	63.79***	63.93***	47.89***	34.52**	17.90	8.49
	(163.66)	(166.13)	(2.78)	(2.04)	(1.13)	(0.55)
Observations	414	372	313	285	313	285
R^2	0.021	0.057	0.112	0.159	0.320	0.370

Notes: Models (1) and (2) are the simplest specifications, (3) and (4) add demographics, (5) and (6) add study subject-areas.

Models (1), (3) and (5) include approaches to learning, and models (2), (4) and (6) include epistemological beliefs.

statistics in parentheses, *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

†64.7% Chinese, (5.5% British, 5.4% other European, 5.6% Indonesian, 4% Thai, 2.2% Indian, 2.2% Taiwanese, 10.4% other non-Chinese, 0% Hong Kong).

"Chinese students" achieved conditional module grades that were approximately 2% to 3% lower than those of non-Chinese students. Most of the association between module grades and prior attainment seems to be picked up by the dummy variables for four "subject areas of study", which have different university entry requirements. A much smaller association is picked up by our instrumented entry-grade point average "IV(UG-GPA%)" indicator reflecting further variation in entry requirement variation between the 29 programmes of study. The *positive* association between father's lower employment status and module grades was not found when the sample was further restricted to US/European (including UK) students. We also examined the possibility that Chinese students whose fathers had lower employment status would be more motivated to signal their ability through achieving higher grades. However, we found no meaningful relationships between interaction terms combining father's employment status and either "deep/achieving" approach to learning or "learner agency" and module grades. The reliability of, and explanation for, the association between Chinese students' module grades and fathers' employment status therefore merits further research.

As a robustness check, we ran imputed regression to account for missing observations and found that this did not noticeably alter the Tables 6 and 7 results. In the imputed regressions, missing values for the AtL factors, EB factors and the IV(GPA) were imputed using all other regressors.[8] Sample sizes increased by between one-hundred and two-hundred observations but the estimated regression parameters and standard errors remained largely unaffected.

5. Discussion

In relation to RQ1, addressed in Table 5, the correlation analysis identified statistically significant associations between AtL and EB factors. The similarity in correlations for both Chinese and non-Chinese students, complemented by the stronger correlations for Chinese students, echo the findings by Leung et al. (2008) when comparing secondary school students in Hong Kong and Sidney. These findings suggest that Chinese students do not exhibit substantially different beliefs to non-Chinese ones. However, in for Chinese students these associations seem stronger.[9]

More specifically, in the subsample of mainland Chinese students (upper part of Table 5), a significant positive association emerged between an EB that knowledge is "certain, simple, and

innate" (*p*-values <0.001) for both an "deep/achieving" AtL (correlation 0.23) and a "surface" AtL (correlation 0.47). Furthermore, a significant positive association emerged between a "deep/achieving" AtL and an EB in "learner agency" (correlation 0.53). These results are consistent with the distinctive "Chinese learning" features identified in previous studies discussed in the "Background and Literature" section. In the subsample of non-Chinese students (lower part of Table 5) only two significant associations (*p*-values <0.001) were detected. The first is a positive association between a deep/achieving AtL and an EB in "learner agency" (correlation 0.58). The second is a positive association between a "surface" AtL and an EB that knowledge is "certaint" and reliant on "authority". A borderline significant association (*p*-value 0.06) was detected between a "surface" AtL and an EB that acquiring knowledge was "quick and simple". As found by Chan (2003), Cano (2005), and Tanriverdi (2012), non-mainland Chinese students exhibited AtL and EB patterns similar to those exhibited by mainland Chinese students in other studies.

In addressing RQ2, we found that mainland Chinese students attained lower Master's-level grades compared to their non-Chinese counterparts, when other characteristics are controlled for. This is evidenced by the negative estimated OLS regression coefficients (ranging from −1.98 to −3.23) on "Chinese student" in Tables 6 and 7. These negative coefficients echo prior findings for undergraduates (Crawford & Wang, 2015; Iannelli & Huang, 2014) wherein mainland Chinese students' performance deteriorates as their degree progresses, and this decline has been intensifying across student cohorts. Unlike some previous studies (e.g., Reid et al., 2007; Diseth, 2007), we found no significant association between AtL and achievement among Chinese students. Only for non-Chinese students, did we find just the "surface" AtL was in some regression models significant and, logically, negative (ranging from −0.64 to −1.51). The absence of significant results is possibly (i) a novel result arising from this study's broader range of demographic control variables, or (ii) simply an erroneous result emerging from this specific sample.

In Tables 6 and 7, we identified modest positive associations between EBs and Master's level grades at the end of the first academic semester, thus confirming previous positive associations found among schoolchildren (e.g., Trautwein & Lüdtke, 2007). Like Tolhurst (2007), we observed a negative relationship between grades and EBs that "knowledge is certain" among non-Chinese students (coefficient range −0.96 to −1.90). Two of these results were significant even though prior attainment and social class were controlled for in the regression models, characteristics not controlled for by Tolhurst (2007). One finding we deem a novel contribution is that mainland Chinese students exhibited a significant positive association between an EB in "learner agency" and higher grades (coefficient range 1.11 to 1.16). The potential implication is that the level of control and autonomy a learner perceives in the learning process can lead to higher grades.

6. Conclusion

These findings hold dual implications for teaching and educational development in higher education. Firstly, Chinese students with a greater belief in their ability to learn achieved higher grades. For practitioners, the EB items with "factor loads" on "Learner Agency" (Table 3) could serve as useful prompts for students in supporting each other's learning. Furthermore, non-Chinese students who considered knowledge as "certain and dictated by authority" attained significantly lower grades. This is interesting because it is often a characteristic attributed to mainland Chinese students but our analysis found it a factor only among non-Chinese students.

Second, we found that Chinese students' grades were approximately three percentage points lower than non-Chinese students', after factors and demographic characteristics were controlled for. This grade gap aligns with previous studies (e.g. Crawford & Wang, 2015; Iannelli & Huang, 2014). However, our findings do not support the proposition by Sun and Richardson (2012) that this gap results from Chinese students adopting AtL that are less effective in western contexts. We also determined that, controlling for other characteristics, Chinese students with fathers in lower-status or blue-collar employment achieved grades more than three percentage points higher than other

Chinese students. This is consistent with the suggestion by Iannelli and Huang (2014) that Chinese students from lower status backgrounds have greater incentives to maximise grades. The implications of this are that allocating more resources towards entry selection could prove effective in identifying more motivated students.

While these findings offer insights, they, like many studies in this field, are limited to one short period time and to one school within a single academic institution. Consequently, we are cautious about making claims on the generality of these results. Future research could apply the same survey instruments (Biggs, 1987; Schommer, 1990) and the same analyses (factor and regression analysis) to students in varied academic departments and institutions, across more than one academic year. In this way, it can be determined to what extent results vary across disciplines and over time. Another challenge is that factor analysis requires a large number of individual observations, particularly when survey instruments include a large number of questions. Only due to the near-full response level from 564 students was the factor analysis able to identify the factors. Table 4 shows that among these 564 students, the number providing a complete set of responses was 423 for EBs, 381 for AtL and 328 for the demographic questionnaire. Future research should aim to create an environment that encourages higher completion rates for each questionnaire, while avoiding intrusiveness and remaining mindful that participation is voluntary.

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Notes
1. Recently, Zhang and Li (2023) used both exploratory and confirmatory factor analysis on a dataset of 469 secondary school students in mainland China to create a *classroom assessment for self-regulated learning questionnaire* consisting of 28 items.
2. Tan (2022) used PISA data for 5355 Hong Kong schoolchildren to map demographic characteristics onto socio-economic status and used these in a multivariate structural equation model of academic performance.
3. Tolhurst (2007) also included an analysis based on Hofer's (2000) discipline focused epistemological beliefs questionnaire.
4. Control of learning, speed of learning, organisation of knowledge, certainty of knowledge, and knowledge is received from authority.
5. Fixed learning, learning effort/process, knowledge is certain, and knowledge is received from authority.
6. Learning is fixed and quick, knowledge is simple, and knowledge is certain and received from authority.
7. One Hong Kong student was removed from the full sample of 565 students.
8. This was carried out using Stata's -mi- procedure, setting thirty imputations per missing case using the -add (30)- option.
9. Leung et al. (2008) also found that the stronger association was also correlated with higher academic performance, particularly in mathematics.

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