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INTERNATIONAL & COMPARATIVE EDUCATION | RESEARCH ARTICLE

Why do Chinese students out-perform those from the West? Do approaches to learning contribute to the explanation?

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Abstract: One of the major current issues in education is the question of why Chinese and East Asian students are outperforming those from Western countries. Research into the approaches to learning of Chinese students revealed the existence of intermediate approaches, combining memorising and understanding, which were distinct from rote learning. At the time, research into the paradox of the Chinese learner was content to establish that the approaches were not consistent with a surface approach and there was, therefore, no reason to anticipate the inferior learning outcomes associated with the approach. This article takes the analysis further to discuss whether the intermediate approaches could be advantageous for academic performance and could contribute to the superior performance, especially in mathematics, of Chinese students. Learning approaches are re-formulated as a continuum between pure surface and deep poles characterised by the presence of understanding and memorisation in the intention and strategy and in the sequence of their use. Evidence is presented of more frequent use by East Asian students of the approaches in the centre of the continuum which make the most use of meaningful memorisation, particularly when it precedes understanding. It is, therefore, possible that East Asian students are more likely to have memorised a knowledge base which enables them to perform better in comparative testing.

ABOUT THE AUTHOR

I am currently a Professor in Curriculum Methods and Pedagogy in the Education Faculty of the University of Tasmania. Prior to this appointment, I worked in Hong Kong for 25 years, initially at the Polytechnic University and then Chinese University. I ended up as a Professor in Higher Education at the University of Hong Kong. I spent six years running an inter-institutional initiative, operating across the eight universities in Hong Kong, known as the Action Learning Project, which supported 90 action research projects in which teachers introduced a wide variety of initiatives aiming to improve the quality of student learning.

PUBLIC INTEREST STATEMENT

The results of comparative international tests, particularly PISA, show Chinese and East Asian students outperforming those from Western countries, particularly in mathematics and science. There are certain to be several contributing explanations, and this article discusses whether approaches to learning might be one. Previous research has found that Chinese learners can make use of an approach which combines memorising and understanding, whereas Western research suggested that students either used a deep approach to seek understanding or a surface approach relying on memorisation. There is evidence of Chinese students using more meaningful forms of memorisation as a precursor to reaching understanding of a topic. Such learning approaches might result in Chinese students having memorised a knowledge base which is a useful precursor for problem-solving, and therefore helpful for the comparative testing.

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Keywords: Chinese learner; comparative testing; PISA; approaches to learning; memorisation; understanding

1. Revisiting the paradox of the Chinese learner

In the last part of the twentieth century, a major research theme focused on trying to explain what became known as the "paradox of the Chinese learner". There were widespread perceptions that Chinese students had a propensity for rote learning, which had been found to be associated with poor learning outcomes in Western educational research. Yet comparative studies had found that Chinese students performed at least as well as their Western counterparts.

Research into the paradox produced two contributing explanations.

(1) Research in Hong Kong and China uncovered evidence of a set of approaches to learning, intermediate between pure surface and deep approaches, which combine memorisation and understanding. Observations of Chinese students apparently attempting to memorise material could have been misinterpreted as rote memorisation, when in fact the memorisation was combined with attempts to reach understanding, and was, therefore, not a surface approach.

(2) When Chinese students do employ a surface approach, it is likely to be a response to perceptions of contextual factors in the teaching and learning environment, rather than as a characteristic of a cultural group or a predominant regional trait.

Since this time, comparative international testing has advanced in ambit and rigour. The performance of Chinese or East Asian students has become very noticeable. The paradox was originally formulated as suggesting that there was no evidence of the inferior performance which might be expected from a preponderance of rote learning. Recent results from the testing by the Programme of International Student Assessment (PISA), reviewed below, would suggest that there is now clear evidence of superior performance.

It, therefore, seems timely to re-examine the body of research into the approaches to learning of Chinese learners in an attempt to see whether it has any part to play in explaining the superior performance. This article, therefore, revisits the research into Chinese approaches to learning to see if the intermediate approaches could contribute to explanations of superior performance. In doing so, it re-considers the nature of approaches to learning and attempts to reconcile the various intermediate approaches with the original characterisation of deep and surface approaches to produce a synthesised characterisation. It also addresses the issue of whether the intermediate approaches are: peculiar to the Chinese; more commonly used by them; or whether they are also employed by Western students. This is an issue which was perhaps not fully resolved and has resulted in a lack of certainty in interpreting the literature.

2. International comparisons

There have been an extensive series of studies comparing the performance of Chinese students with others. Reviews have been conducted by Stevenson and Lee (1996) and by Hau and Ho (2010).

International comparative research studies have been conducted on mathematics, science and reading. Mathematics has been compared most often, presumably because it is easier to devise tests which are not biased by language, culture or curricula.

Earlier studies compared ethnic or immigrant groups within countries such as the USA, UK, Australia, Canada and the Netherlands (Stevenson & Lee, 1996). The reviewers' interpretation of results from these studies is that the Chinese perform well compared to other minority groups or the population as a whole.

The comparative studies have progressed to making cross-country comparisons. A series of studies were conducted by the International Association for the Evaluation of Educational Achievement comparing performance in mathematics and then science. The most convincing and most highly cited evidence of high performance by Asian students comes from the international comparisons organised by the Organisation for Economic Co-operation and Development known as the PISA. The third PISA tests, compared performance of 15-year-olds in 57 countries and regions (Organisation for Economic Co-operation & Development, 2007). In science and reading two of the top four spots went to Asia, while in mathematics they filled three of the top four places. In the 2012 testing of 15-year-olds, the top seven places in mathematics were taken by Asian countries (Organisation for Economic Co-operation & Development, 2012). These top seven countries/regions were, in order: Shanghai, China; Singapore; Hong Kong, China; Chinese Taipei; Korea; Macau, China; Japan.

2.1. Focus

The top seven places in these PISA rankings are all in the East Asian region. It is also true to say that all are Confucian-heritage countries or regions. Five are either part of China or predominantly peopled by Chinese.

The title of the article refers to Chinese students rather than to East Asians. The main reason for this is that the large part of the research drawn upon in the analysis was conducted on Chinese students or refers to the Chinese as a cultural group. The topic of work which was the original inspiration has become known as "the paradox of the Chinese learner" because it investigated the approaches to learning of Hong Kong and Chinese students. In addition there is a whole genre of research into the psychology of the Chinese, as evidenced by two substantial compilations edited by Michael Bond (1996, 2010).

3. The paradox of the Chinese leaner

Research into the paradox of the Chinese learner was prompted by a commonly advanced perception that Chinese learners were more prone than their Western counterparts to employ rote learning. The observation had been widespread in anecdotal form, but affirmations in print are also quite common. I see no point in extensively reviewing this literature as the research into the Chinese learner suggests that it is largely a mis-perception. The following quotation, from the official minutes of a course planning committee in one of the universities in Hong Kong, is sufficient to establish how entrenched negative perceptions of Chinese students were at the time systematic investigations of the perceived phenomenon started.

> Students in Hong Kong … expect lecturers to teach them everything that they are expected to know. They have little desire to discover for themselves or avail themselves of the facilities which are available to them within the teaching institution. They wish to be spoon fed and in turn they are spoon fed. Lecturers are under pressure to feed the student with a certain amount of academic and community needs information and the simplest way to do it … is to adopt the old and traditional approaches to teaching. (Minutes of the […] Course Planning Committee, 1989, p. 13)

This perception, though, has been seen as an inconsistency which has become known as the "paradox of the Chinese learner" (Watkins & Biggs, 1996). Rote learning is seen as an undesirable approach to learning, which when adopted by Western students has tended to be associated with poor learning outcomes. Rote learning has been associated with a surface approach to learning, which is normally envisaged as less desirable than a deep approach, particularly in higher education. Abundant research into approaches to learning has shown that such an approach to learning should lead to poor learning outcomes (for reviews and overviews see Dart & Boulton-Lewis, 1998; Marton, Hounsell, & Entwistle, 1984; Prosser & Trigwell, 1999; Richardson, 1994, 2000).

4. Deep and surfaces approaches to learning

The original characterisation of approaches to learning was essentially dichotomous. Marton and Säljö (1976) claimed that when students were asked to read an academic text they either adopted a deep approach, by trying to understand the underlying meaning intended by the author, or a surface approach in which superficial features are committed to memory. Fuller characterisations of deep and surface approaches (e.g. Biggs, 1987, p. 15; Entwistle, 1998, p. 74) are consistent with the portrayal by Kember and McNaught (2007, p. 25).

Deep approach:

- A deep approach is adopted when the student is interested in the topic or the academic task.
- As a result, there is an attempt to understand key concepts or the underlying meaning of an article.
- An attempt is made to relate together the concepts to make a coherent whole. A piece of writing will be logically related with an introduction and conclusion.
- New knowledge will be related to previous knowledge and to personal experiences.

Surface approach:

- An activity or assignment is undertaken because it is a set task and the course cannot be passed unless the assignment is completed. The task does not arouse interest.
- As a result, the minimum possible time and effort is devoted to the task.
- There is no attempt to reach understanding of key concepts; instead, reliance is often placed upon memorisation of model answers or key facts perceived as likely to appear in tests or examinations.
- Coherence of the topic is not sought; so material is seen as a set of unrelated facts.
- Concepts are not related to personal experience; so remain as abstract theory. As a result what has been memorised is normally quickly forgotten.

A large volume of research into approaches to learning followed from the initial study, with the bulk of the work in the seventies, eighties and early nineties taking place in the West (for overviews of Western research into approaches to learning, see Marton et al., 1984; Prosser & Trigwell, 1999; Richardson, 2000). The corpus of studies largely served to reinforce the accepted position that students adopted either deep or surface approaches to learning depending on their perception of the learning task and the prevailing teaching and learning environment.

5. Intermediate approaches

The existence of the "paradox of the Chinese learner" stimulated research into approaches to learning in Hong Kong and to a lesser extent in mainland China. The anecdotal accounts of widespread rote learning were confounded by surveys of approaches to learning of students in Hong Kong. Initial results, from a substantial sample at one university in Hong Kong, showed mean deep approach scores on the Study Process Questionnaire (SPQ, Biggs, 1987) higher than a comparable Australian sample (Kember & Gow, 1991). The results were consistent with surveys in other institutions, reviewed in Biggs (1992).

The surprising survey results provided further stimulus to researchers in the field to seek solutions to the paradox of the Chinese learner. The investigations began to provide evidence of approaches to learning inconsistent with the original Western formulations of deep and surface approaches. A combination of comparing factor structures of questionnaire data with those from elsewhere and interviews with students about their approaches to tackling specific academic tasks suggested that memorisation might be occurring in conjunction with attempts to reach understanding (Kember & Gow, 1989, 1990). Students utilising the approach worked systematically through material section-by-section, attempting to understand each new concept and then commit it to memory before proceeding to the next. The following interview quotation illustrates the "narrow approach".

> I read in detail section by section. If I find any difficulties I try my best to solve the problem before I go onto the next section. … If you don't memorise important ideas when you come across them then you will be stuck when you go on. You must memorise and then go on—understand, memorise and then go on—understand, memorise and then go on. That is my way of studying. (Kember & Gow, 1990, p. 361)

Other intermediate approaches have subsequently been identified. Tang (1991) observed students initially employing a deep approach by trying to understand concepts, but then committing the material to memory to satisfy assessment requirements. This intermediate approach was used by students who had a preference for seeking understanding, but recognised that their examinations normally required them to reproduce material. They, therefore, tried to understand the concepts and then made sure the material was memorised so they could get a good grade in the examination.

Marton, Dall'Alba, and Kun (1996) distinguished mechanical memorisation and memorisation linked with understanding. They reported two combinations of the latter, distinguished by whether the attempt to understand came before or after the memorisation. When understanding came first, the process involved making conscious efforts to remember that which had been understood. The approach with understanding preceding memorisation is similar to the narrow approach described by Kember and Gow (1989, 1990).

When memorisation came first, it could be used as an attempt to reach understanding. Dahlin and Watkins (2000) found that 90% of a sample of Hong Kong Chinese students could remember reciting texts at primary or junior secondary school. There were several mechanisms by which repetition could go beyond mechanical memorisation towards reaching an understanding of the text. The most common among the Hong Kong Chinese students was that repetition plus attentive effort led to new meanings. This approach to learning may be a legacy of learning a character-based language, which is traditionally learnt through repetition of the characters.

The requirement for repetition to be accompanied by attentive effort suggested that Chinese students tend to see understanding itself as a long process requiring much effort, rather than as a rapid insightful process which Western students are more likely to believe (Dahlin & Watkins, 2000). This was consistent with the work of Elliot and Chan (1998), who found that describing the epistemological beliefs of Hong Kong Chinese students needed a dimension called "belief that learning requires significant effort" (p. 8).

Hess and Azuma (1991) also found evidence of memorisation in conjunction with attempts to reach understanding. The approach described was most consistent with memorisation and repetition being used as an attempt to reach understanding. The finding of this approach in Japan and mainland China might, therefore, indicate a connection with the learning of character-based languages.

Tang (1993) found variants on a surface approach in which Hong Kong school students made limited attempts to order or understand material to reduce the memorisation load. The approach was called an elaborated surface approach. The students initially intended to memorise material but found the memory load became such that some selection became necessary as they progressed through the school.

Watkins (1996) interpreted interviews with Hong Kong secondary school students as showing that students developed through a sequence of three or four stages. Initially, their intention was to achieve through reproduction, by rote learning everything. The students then passed to the next stage of rote learning things perceived as more important. In the subsequent developmental stages, the students started to see the benefit of trying to understand material before committing it to memory. The existence of the stages could be interpreted as a developmental process in which students progressively refine their learning approaches by seeking heightened levels of understanding, while still clinging to predominantly reproductive conceptions of learning.

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The discovery of the intermediate approaches provided one of two contributing explanations for the paradox. Approaches to learning were originally portrayed in the West as competing deep and surface approaches. At least some Chinese students apparently observed memorising material could also have been trying to understand. Those noting symptoms of students appearing to be memorising material may have interpreted their observations as suggesting that the students were rote learning or employing a surface approach consistent with the original Western formulation. Whereas the students may well have been employing one of the intermediate approaches, so reaching some level of understanding as well as committing material to memory. Observations of apparent memorisation may, therefore, not have precluded seeking understanding, which had been seen as the superior approach.

It is of interest to compare the intermediate approaches with models of Chinese learning derived by Li (2002) from an emetic cultural perspective. The behavioural ideal model contained multiple elements with many being related to hard work. The model also featured repeated actions if learning was not mastered. This model is more elaborate and more specific than the intermediate approaches to learning combining memorising and understanding, but is certainly consistent with it.

6. Approaches to learning as a continuum

The preceding section has reviewed a set of studies which produced evidence of various forms of intermediate approaches to learning displayed by students in Hong Kong and/or China. Apart from the initially discovered narrow approach, the presentation of the intermediate approaches has been in order from those closest in form to a pure deep approach to those closest to a pure surface approach.

As there appears to be a logical progression in the form of the intermediate approaches, it has been suggested that approaches to learning be envisaged as a continuum between pure deep and surface poles (Kember, 1996, 2000). The positions on the continuum can be distinguished by the various forms of combining memorisation and understanding.

Table 1 develops upon previous formulations of the continuum (Kember, 1996, 2000) by characterising the approaches by the intention and strategy employed. The sequence in which the elements of the strategy are employed is also of significance, so the final column in the table is labelled sequence. This formulation permits a full characterisation of all of the approaches reviewed in the previous section and shows that each is distinct, but related in a logical sequence.

Table 1. Approaches to learning as a continuum between deep and surface poles				
	Approach	**Intention**	**Strategy**	**Sequence**
1	Pure deep	Understanding	Seeking comprehension	Understanding
2	Deep then memorising for assessment	Primarily understanding	Strategic memorisation for examination or task after understanding reached	Understand then memorise
3	Narrow approach	Understanding and memorising	Concept by concept, understand then memorise	Understand then memorise
4	Repetition to reach understanding	Memorising and understanding	Repetition and memorising to reach understanding	Repetition to memorisation to understanding
5	Limited attempt to understand	Memorisation	Strategic attempt to reach limited understanding as an aid to memorisation	Limited understanding then memorisation
6	Strategic memorisation	Memorisation	Memorisation of model answers	Memorisation
7	Pure surface	Memorisation	Rote learning	Rote learning

The table appears to encompass the approaches as defined by conceivable combinations of memorisation and understanding in an orderly sequence. Moving up the table, there is a logical progression through the sequence of approaches. Watkins (1996) interpreted his research on secondary school students as evidence of a developmental sequence. Students started with a pure surface approach and proceeded up the hierarchy stage by stage. Approaches to learning have not commonly been portrayed as developmental stages, possibly because most research under the SAL paradigm has been in the higher education sector. Child development models have followed other paradigmatic approaches. It might be noted, though, that a development through predominant learning approaches would be consistent with developing epistemological beliefs through a category scheme such as that of Perry (1988).

7. Cross-cultural comparison of approaches

Initial examinations of the cultural specificity of approaches to learning with quantitative data compared factor structures from the two original instruments for measuring approaches to learning: the Approaches to Studying Inventory (ASI) (Ramsden & Entwistle, 1981) and the Study Process Questionnaire (SPQ) (Biggs, 1987). It might be noted that these instruments were both designed before any of the qualitative evidence for intermediate approaches to learning, so both had main scales for deep and surface approaches.

Richardson's (1994) extensive review of quantitative data came to the conclusion that there was a "broad distinction between two fundamental approaches to studying: first an orientation towards comprehending the meaning of the materials to be learned; and, second, an orientation towards merely being able to reproduce those materials for the purposes of academic assessment" (p. 463). He interpreted the results as indicating that the former orientation was consistent but the latter was fragmented or more varied in form.

The conclusion of two broad orientations is consistent with subsequent work which has used structural equation modelling to examine the dimensionality of questionnaire data. The results are from data gathered with the old versions of the Learning Process Questionnaire (LPQ) and the SPQ (Biggs, 1987). The LPQ is designed for secondary school students and the SPQ for university students. Wong, Lin, and Watkins (1996) tested six models on 10 LPQ data-sets from various countries and found the best fit was for two-factor structures. Kember and Leung (1998) tested seven models for both LPQ and SPQ data-sets and again concluded that there was evidence for two factors.

A substantial body of quantitative data from students on most continents, therefore, found no evidence of cultural specificity for approaches to learning. The instruments used were not specifically designed to measure the intermediate approaches. However, if Chinese, Asian or other students were employing a radically different set of learning approaches the extensive body of research should have shown evidence of it.

Since these results, the SPQ and the LPQ have been revised to take into account knowledge discovered about approaches to learning since the development of the original instruments (Biggs, Kember, & Leung, 2001; Kember, Biggs, & Leung, 2004). The revised Study Process Questionnaire (R-SPQ-2F, Biggs et al., 2001) was completed by large samples of university students in Australia and Hong Kong (Leung, Ginns, & Kember, 2008).

Multiple-group analyses using structural equation modelling showed configural invariance, implying that students from the two countries were employing the same conceptual frame of reference when responding to the R-SPQ-2F. This suggests that the continuum characterisation of approaches to learning is likely to be applicable for Western as well as Chinese subjects. The correlations between deep and surface approaches for universities in both Hong Kong and Sydney were negative (Hong Kong = −0.39, Sydney = −0.63). These substantial negative correlations are consistent with the continuum model of approaches to learning, as they imply that the deep and surface approaches can be envisaged as opposite ends of a spectrum.

The conclusion from the substantial body of work reviewed in this section would appear to be that there is no clear evidence for cultural specificity of approaches to learning. This might, therefore, be interpreted as suggesting that the model of a continuum between deep and surface poles provides a universal framework for describing approaches to learning.

8. Utilisation of intermediate approaches

If the continuum model provides a framework for describing approaches to learning which applies universally, the next issue to address is the extent to which intermediate positions are found in parts of the world other than East Asia or Confucian-heritage countries. The work to uncover an explanation for the paradox of the Chinese learner was mostly conducted in Hong Kong with some data gathered in China. The concentration on students in this region was eminently sensible since the researchers were seeking an explanation for a perceived phenomenon specific to the region. The discovery of the intermediate approaches provided an explanation for an apparent cultural paradox. There was, then, no reason for those investigating the paradox to look outside the region where the paradox was believed to operate.

Once the existence of the intermediate approaches is taken further to re-examine the wider characterisation of approaches to learning, it does then become appropriate to ask whether there is evidence of intermediate approaches in other parts of the world. It is quite probable that this question had not been asked prior to the research in Hong Kong. The deep–surface model of approaches to learning had provided a perfectly adequate explanation for Western research and a good model for educational development work in higher education. The SAL paradigm based on the deep–surface model had become dominant for research in learning and teaching in higher education outside North America.

8.1. Quantitative data

The overwhelming conclusion of the main section above was that quantitative data supported a two-factor structure for approaches to learning. In some ways, this was surprising. While the two main instruments for measuring approaches to learning were based on the deep–surface model, both included other scales or factors. The SPQ had a factor for an achieving approach (Biggs, 1987), while the ASI had various scales which were usually said to constitute a strategic approach (Ramsden & Entwistle, 1981).

In most of the studies discussed in the previous main section, these additional factors and scales were found to load on the two main factors highlighted in Richardson's (1994) review. The finding that scales designed to describe approaches other than pure deep and surface approaches were incorporated into a two-factor structure could be interpreted as being consistent with the continuum model between deep and surface poles. It is not reasonable to claim that it provides strong evidence for the continuum, but it is certainly not inconsistent with it.

Richardson's (1994) review of quantitative work on approaches to learning concluded that there was overwhelming evidence for the two main factors. There was less conclusive evidence of a third factor with varying characteristics depending on the sample and the questionnaire. Factor analysis of a Hong Kong sample of the ASI produced a first factor with strong loadings from operation learning and improvidence (Kember & Gow, 1990, 1991). This was used as evidence for the existence of the narrow approach. The third factor might, therefore, be seen as consistent with the intermediate positions in the continuum model. However, the inconsistency in both the nature of the third factor and whether it was found in particular samples does little to resolve the issue of the cultural applicability of the intermediate positions.

The Leung et al. (2008) study, which showed configural invariance on the R-SPQ-2F between large samples in Australia and Hong Kong, went on to compare mean deep and surface approach scores. The Hong Kong sample was higher on both deep and surface approaches, with the difference on surface approach being substantially larger than for deep approach ($d = 0.75$ vs. $d = 0.24$,

respectively). The difference in mean scores suggested cultural differences in the extent to which particular approaches are employed. The Hong Kong sample seemed to have a greater propensity to employ combinations of approaches or intermediate approaches.

There have been three studies (Chiou, Lee, & Tsai, 2013; Lee, Johanson, & Tsai, 2008; Lin & Tsai, 2013) of Taiwanese students' approaches to learning science with the revised Learning Process Questionnaire (R-LPQ-2F) (Kember et al., 2004). Cheng and Wan (2016) reviewed the results as indicating that the students were more likely to use deep rather than surface approaches. The R-LPQ-2F, though, is a two-factor instrument and scores on both factors were substantial, so the results were not inconsistent with some level of intermediate approaches.

8.2. Qualitative data

The evidence of intermediate approaches came first from Chinese students in Hong Kong. Evidence of the intention to both memorise and understand was also found in mainland China (Marton et al., 1996) and Japan (Hess & Azuma, 1991). The approach described by Hess and Azuma (1991) fits best to the position on the continuum in which memorisation precedes understanding.

There is also evidence of intermediate positions, particularly those closer to the deep and surface poles of the continuum in the West. This seems perfectly logical as these positions on the spectrum seem most likely to be adopted as responses to prevailing learning and assessment contexts.

Entwistle and Entwistle (2003) investigated the approaches to learning and strategies of students revising for examinations. A common revision sequence was found to consist of: an initial review of lecture notes; developing a structure to frame understanding; committing the framework to memory and ensuring that the memorisation was primed for the examination. The position on the continuum can be equated to that described by Tang (1991), as the approach seeks an understanding followed by memorisation to ensure good examination performance.

Case and Marshall (2004) identified intermediate procedural approaches to learning in engineering students in South Africa and the UK. Algorithmic and procedural deep approaches were identified with both having a focus on problem-solving. The algorithmic approach involved identifying and memorising formulae and procedures for solving problems. Such an approach would not require an understanding of the underlying concept. The algorithmic approach can be related to the elaborated surface approach of Tang (1993), as manifested by engineering students, since it does not seek understanding, but involves some selective ordering prior to memorisation. The procedural deep approach also used procedures and algorithms for problem-solving, but the students had the intention of reaching an understanding of the concepts involved. The approach might be equated to that of Tang (1991) in a discipline-specific form, since assessment in engineering concentrates on problem-solving.

8.3. Intermediate positions on the continuum

Table 2 takes the approaches other than the deep and surface poles from Table 1 and summarises the discussion in this section. It very clearly makes the point that there is convincing evidence of Western use of intermediate position near the poles. However, evidence of the central positions in the continuum, which make the most use of combinations of understanding and meaningful memorisation, appears to be restricted to Chinese and East Asian students.

The comparison of uses of intermediate positions on the continuum suggests that there is convincing evidence of Western use of approaches near the pure deep and surface poles. It makes perfect sense to find the approaches near the poles in the West as their use has been related to assessment demands which are independent of context. The approach described by Tang (1991) in Hong Kong and Entwistle and Entwistle (2003) in Edinburgh is very similar because it is a logical approach to revising for examinations. The students first seek an understanding of material then commit important elements to memory. The approach is an inevitable consequence of examinations

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Table 2. Evidence of use of intermediate approaches in the East and West				
	East		**West**	
	Approach	**Reference**	**Approach**	**Reference**
2	Deep then memorising for assessment	Tang (1991)	Understanding and memorising during revisiondeep procedural	Entwistle and Entwistle (2003)
				Case and Marshall (2004)
3	Narrow approach	Kember and Gow (1989, 1990)		
4	Repetition to reach understanding	Marton et al. (1996)	`	
		Dahlin and Watkins (2000)		
		Hess and Azuma (1991)		
5	Limited attempt to understand to reduce memory load	Watkins (1996)		
6	Elaborated surface	Tang (1993), Watkins (1996)	Algorithmic	Case and Marshall (2004)

being used as a form of assessment, particularly when the examinations reward those able to reproduce bodies of knowledge. Even in examinations which test higher order skills, such as application and extension, the ability to recall a foundation knowledge base is a distinct advantage.

The approaches nearest the surface pole were also adopted for assessment purposes. The surface procedural approach to problem-solving (Case & Marshall, 2004) is a sensible way to tackle many of the numerical problems which engineering and science students are set in assignments and examinations. Watkins (1996) interpreted his results from school students as showing that students adopted a logical progression of approaches involving less mechanical memorisation as more material needed to be remembered. It is probable that there would be much greater evidence in the West of approaches close to the surface pole if the SAL paradigm had been employed more often in research with school students.

Of the positions in the middle of the continuum, there is little evidence of their use by Western students. For the approach in which memorisation comes first, there do not appear to have been any cases found in Western studies.

It is possible that the approaches combining understanding and memorisation near the centre of the continuum may be more common in Asia as Kember (1996) has speculated that their adoption may be language-related. Memorising as a pre-requisite to understanding (Hess & Azuma, 1991; Marton et al., 1996) seems to be a natural progression from the traditional way of learning a character-based language and the narrow approach (Kember & Gow, 1990) also seems likely to be more prevalent among those who have had to memorise characters. The narrow approach may also be influenced by learning in a second language, as those who lack fluency in a language find it difficult to gain a holistic overview when reading, so concentrate narrowly, section-by-section.

Dahlin and Watkins (2000) found that 90% of a sample of Hong Kong Chinese could recall reciting texts during their early schooling, suggesting that it is a very well-entrenched form of learning. The common use of memorisation in early learning would act as a form of conditioning into the use of memorisation as a normal learning approach. This could be the reason for the more common use of the intermediate approaches in the East. Students would tend to grow up feeling that memorisation is a normal way of studying and a legitimate learning strategy. In the West, it appears that some students might well be not encouraged, or even discouraged, to engage in ways of learning which involve memorisation.

9. The intermediate approaches and performance

The intermediate approaches could provide one explanation for the good performance of Chinese students. Seeking understanding or employing a deep approach tends to be associated with positive academic outcomes. It is hard, if not impossible, to perform tasks which are more complex than re-production or routine application without a reasonable understanding of the underlying constructs.

There are, though, also advantages to studying if memorisation is employed in addition to gaining understanding. In which case, employing one of the combined approaches offers the best of both worlds. The least justifiable case is that assessment often requires little more than reproduction, so rewards those who have committed material to memory.

There are much more positive rationales for the role of memorisation in learning if it is in combination with attempts to reach understanding. Performing higher level tasks can often be difficult or impossible without basic knowledge which needs to be committed to memory. Good examples are from two of the most fundamental areas of learning.

When learning a language, it is hard to make progress without memorising a basic vocabulary and the fundamental rules of grammar. These necessary acts of memorisation are not surface learning. They are not trivial tasks undertaken just because they are set by the teacher. Students can work very hard at the task of memorising such foundation knowledge, which indicates that they are not employing a surface approach, which is characterised by minimising effort.

In mathematics, many computations are difficulty to perform unless the multiplication tables have been learnt. Performing calculations is facilitated if procedures and formulae have been com-mitted to memory—but not if unaccompanied by an understanding of underlying principles as that leads to a mechanical algorithmic approach. Having a good recall of procedures and formulae cer-tainly helps in tests with a time limit, including those with problems which require extrapolation beyond basic applications. The implications for PISA results are obvious.

Chinese students should be good at these learning tasks which require, prerequisite, bodies of material to be memorised. One reason is this greater propensity for employing intermediate ap-proaches to learning which incorporate both understanding and memorisation. They are also trained to be good at memorisation, in their early years of schooling, because of the need to learn a charac-ter-based language. Indeed the time and effort spent in constant rehearsal and reciting while learn-ing the characters at an early age may well be a possible explanation for the greater propensity to use intermediate approaches.

If, as seems possible, Chinese and perhaps East Asian students have a greater propensity to em-ploy approaches to learning near the centre of the continuum, it is the approaches in which memo-risation plays the most significant roles which are the greatest distinction between East and West. This is consistent with the solution to the paradox, since it arose because Western observers had confounded rote learning with forms of memorisation not associated with a surface approach.

The conclusion to be drawn out is that there are three quite distinct forms of memorisation, which characterise separate positions on the approaches to learning continuum:

- mechanical memorisation or rote learning
- meaningful memorisation associated with understanding
- memorisation as a pre-requisite for other meaningful learning activities.

The first of these is associated with a surface approach to learning. It is a universal approach adopted in response to perceptions of well characterised types of teaching and learning assignments (Dart & Boulton-Lewis, 1998; Marton et al., 1984; Prosser & Trigwell, 1999). The second of these has been identified in both East and West. The study by Leung et al. (2008) suggested that it was more prevalent in Hong Kong Chinese than Australian students. The final form of memorisation, which is a precursor to understanding or meaningful learning, has so far only been identified in East Asian studies. The most likely explanation being that it is associated with the traditional way of learning character-based languages.

10. Devaluing of memorisation in the West?

The SAL paradigm and the deep–surface model of approaches to learning has become the dominant theoretical model for higher education; not just for research, but also for teaching quality improvement. Those responsible for enhancing the quality of learning and teaching encourage teachers to adopt teaching practices and assessment conducive to a deep rather than a surface approach. It also would be reasonable to claim that a predominant theme across much of the Western educational psychology literature is that teachers should be promoting meaningful learning outcomes.

The corollary of these positions is that rote learning is discouraged. Given the confounding of memorisation with rote learning in the Chinese learner research, it is possible that the discouragement of rote learning may have been extrapolated towards rejecting memorisation and removing from the curriculum forms of learning requiring it. However, such a position again confounds memorisation with rote learning or a surface approach. Devaluing memorisation may have left students lacking an important knowledge base for performing subsequent learning tasks.

Rote learning tends to be associated with didactic forms of teaching in which bodies of content are delivered with the expectation that they will be learnt by heart and reproduced in examinations. The teaching approaches advocated as an alternative are more activity-based forms of learning.

Again, though, in the implementation in practice, there may have been an over-interpretation. Activity per se does not automatically lead to desired learning outcomes. Indeed poorly conducted activities can result in confused outcomes, with students remembering the activity itself rather than the conclusion which was meant to be drawn from it. De-briefing or drawing out conclusions from the observations of the activity is essential if meaningful learning outcomes are to result. However, successful de-briefing is not an easy teaching skill to master.

11. Conclusion

The conclusion demands an attempt to address the questions posed in the title. The article has built a case that it is highly plausible that approaches to learning play some part in the superior performance of Chinese and East Asian students in comparative international testing. It is possible that it may be a small part and it is certainly not the only explanation.

A case has been made for portraying approaches to learning as a continuum between deep and surface poles, with positions on the continuum defined by the ways in which memorisation and understanding are used. Western students make less use of intermediate approaches near the centre of the continuum which make regular and routine use of meaningful memorisation. This appears to be a consequence of memorisation and repetition being less useful for learning alphabetical, rather than character-based languages. It is possible that predominant teaching and learning approach in Western educational psychology, with an emphasis on meaningful learning and a deep approach, may have inadvertently devalued memorisation, thus extenuating differences in the employment of memorisation between East and West.

A possible consequence is that Western students lack an appropriate knowledge base, which could have significant consequences for performance in mathematics and science. It is common for mathematics and science curricula to be based on a building-block approach in which a concept

builds upon those taught previously. If the previous concepts have not been understood, and that understanding committed to memory, the foundations for learning the new concepts are inevitably shaky. Possession of an appropriate knowledge base is an important part of higher order forms of learning like problem-solving and critical thinking. If Western students do lack an appropriate knowledge base, this would be apparent in tests of mathematics and science in which application and problem-solving are tested, particularly when there are time constraints.

11.1. Further research
The conclusion drawn is that Chinese students make more use of approaches to learning involving memorisation and understanding and, therefore, are more likely to have built up a good knowledge base. This would then contribute to their superior performance in international testing, particularly in mathematics and science. The evidence presented for this conclusion could be interpreted as highly plausible, but not definitely proved. It would, therefore, be of value to further investigate the hypothesis.

An empirical approach which should yield stronger evidence would be comparative testing comparing performance on items which are likely to benefit from a sound prior knowledge base with performance on items which can readily be solved from first principles and would not be advantaged by a memorised knowledge base. Arranging international comparative testing with a sound design is complex and expensive, especially if a wide range of countries is sampled. The PISA testing is accepted as definitive. It would be preferable to make use of results from past PISA tests, rather than conduct additional testing.

Panels of mathematics and science experts could be asked to examine past test papers and rate items for the degree of benefit likely to accrue to those with a substantial memorised knowledge base. If the hypothesised conclusion is to be substantiated, Chinese and East Asian students should have a greater performance advantage over Western students on such items as compared to items which need to be solved from first principles.

11.2. Implications for Western education
If further more detailed comparison of Eastern and Western performance does show that there is an advantage from a superior knowledge base, there would be implications for Western education. Western educators might consider the suggestion that they have devalued the benefits of memorising a knowledge base.

11.3. Is there a downside for the Chinese learner?
There have been concerns that the approaches to learning of Chinese learners may have helped their performance in comparative testing, but may have left them deficient in higher order thinking skills, such as creativity and critical thinking. However, this is essentially what the body of research into the paradox of the Chinese learner was about.

That research found, to great surprise at the time, that the Chinese learner was actually more likely to display deep approaches to learning than Western ones. Watkins and Biggs (1996) compiled a collection of the initial work. Leung et al. (2008) confirmed this finding with a sophisticated comparison of large samples. If the Chinese learner is more likely to utilise a deep approach then it seems unlikely that there would be major differences in higher order thinking skills, as a deep approach is a precursor to them.

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