Does a Critical Constructivist Learning Environment Encourage a Deeper Approach to Learning?

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This research showed that a critical constructivist learning environment could be successfully implemented in two Economics secondary classrooms of Hong Kong Chinese students. Students in the higher ability class reported changing to meaning-oriented learning motivation and strategies compared to those in the lower ability class or a control class. Awareness of the nature of the new learning environment was related to this shift to a deeper level approach in learning.

It has long been recognised that meaningful learning strategies (sometimes referred to as a deep approach to learning) are necessary if high quality learning outcomes are to be achieved (Ausubel, 1968; Biggs, 1979; Weinstein, Underwood, Wicker, & Cubberly, 1979). However, ideas about the kind of learning environment most likely to encourage such strategies have changed over the last twenty years.

A quantitative review of the literature by the second author (Watkins, 2001) showed that deep approaches to learning were associated with learning environments characterised by teacher involvement, teacher support, student collaboration, student collaboration, student enjoyment, and an achievement-orientation in schools in Australia, Egypt, Hong Kong, Nigeria, and the USA (Abd-Elsamie, 1998; Haertel, Walberg, & Haertel, 1981; Ramsden, Martin, & Bowden, 1989; Watkins & Akande, 1993; Wong & Watkins, 1996).

Reforms in education in many countries have typically encouraged a change from teacher-centred, transmission-oriented learning environments to more student-centered, constructivist ones (e.g. American Psychological Society, 1995; Education Commission of Hong Kong, 2000). The primary reason usually given for the need for such changes is that such environments encourage more creative, independent, problem-solving, life-long learners. But how valid is such a claim?

This question is complicated because of changing conceptions of what is meant by constructivist (Windschitl, 2002). First to become well known was *cognitive constructivism*. Based on the work of Piaget (1971), this view argues that meaningful learning requires learners to construct rather than receive knowledge. Individual learners develop concepts about different aspects of the world around them based on their own intuition, which may be at odds with those held by experts

and their teachers. From this perspective, the teacher's role is to assist students to modify their views to become more in line with the latter groups. According to Appleton and Asoko (1996) a typical learning environment reflecting a cognitive constructivist approach would involve the teacher becoming aware of the preconceptions of his or her students; the teacher clearly defining conceptual goals for the students and understanding the processes needed to achieve these goals; challenging the initial views of students and helping them become aware of alternative views; and providing opportunities for students to try out new ideas in a non-threatening class atmosphere.

A contrasting approach, based on the work of Vygotsky (1978), is often referred to as *social constructivism* (Brown, Collins, & Duguid, 1989). While recognising that knowledge is personally constructed, this view insists that cultural experiences and interactions with others in social settings mediate each individual's constructions of meaning (Glaserfeld, 1993; Tobin, 1993). Instructional approaches congruent with this perspective include 'communities of learners' advocated by Brown (1997) and computer-supported collaborative knowledge building (Scardamalia & Bereiter, 1994).

While traditional learning environment research such as that of Moos and Trickett (1974) and Fraser (1981) assumed that an actual learning environment exists and that a class mean on an appropriate questionnaire is the best measure of it, the social constructivist approach argues that each class member may have a different perspective of that learning environment.

The Constructivist Learning Environment Scale (CLES; Taylor & Fraser, 1991) was designed to assess the degree to which the teaching of science and mathematics followed constructivist principles. Changes to the CLES have mirrored changing views of constructivism. The original version of the CLES was based on a view of constructivist reform, which emphasised the role of students in constructing their own knowledge, and of the salience of student interactions influencing such construction that is reflected constructivism as portrayed in the above cognitive and social perspectives.

However, according to Taylor, Fraser, and Fisher (1997) the original CLES did not focus on the role of the cultural context in influencing the learning environment as advocated by proponents of *critical constructivism* (Taylor, 1996). According to this view there are

> "major cultural myths that can counteract the development of constructivist learning environments, such as powerful cultural myths rooted in the histories of science or mathematics and of schooling." (Taylor et al., 1997, p.293)

The two main cultural myths underlying the traditional teacher-centered approach according to these authors are an objectivist view of the nature of knowledge and an accompanying *technical controlling* view that focuses on the curriculum as a product to be transmitted. Taylor et al. (1996; 1997) argued that unless these 'myths' were acknowledged and guarded against, a true constructivist learning environment was not possible.

Therefore, a new version of the CLES (Taylor et al., 1997) was developed to monitor this critical learning perspective. This version involves five scales designed to tap five important indicators of a constructivist learning environment: personal relevance, uncertainty, critical voice, shared control, and student negotiation. The worth of the new CLES has been demonstrated by in-depth qualitative research and large scale psychometric studies in Australia, the USA, and Taiwan (Aldridge, Fraser, Taylor, & Chen, 2000; Taylor et al., 1997).

Aims of Research. The ultimate test of an approach to teaching and learning such as critical constructivism is whether it results in higher quality learning outcomes than the traditional teacher-centred approach or other forms of constructivist-

based teaching. There is much research that has shown the value of a *cognitive constructivist* approach in this regard. See, for example, research supporting cognitive strategy instruction (Pressley, 1990), reciprocal teaching (Rosenshine & Meister, 1994), and cognitive conflict (Hewson & Thorley, 1989). The worth of teaching approaches based on *social constructivism* has also been supported in studies on communities of learners (Brown, 1997), cognitive apprenticeship (Collins, Brown, & Newman, 1989), and collaborative knowledge building (Scardamalia & Bereiter, 1994).

As far as the authors are aware, the value of teaching based on a *critical constructivist* approach for enhancing high quality learning outcomes, although promulgated has yet to be demonstrated empirically. The current research was an attempt to investigate whether a shift to such a teaching approach would result in students adopting deeper approaches to learning which is necessary for such learning outcomes. The context of this research also was a test of the generalizability of this approach as it was originally developed and then promoted mainly in Western science and mathematics classrooms. Would the approach be of value in Economics classrooms for Hong Kong Chinese secondary students?

The Hong Kong Context. Current educational reforms in Hong Kong have advocated more student-centered constructivist teaching methods (Education Commission of Hong Kong, 2000). The main need for such changes might be due to the perception that Hong Kong students are too prone to rote learning and lack creativity, the class sizes are too big, and teacher-talk is the default teaching method (see Watkins & Biggs, 1996 for a fuller discussion). This view is supported by findings of recent international comparisons of educational achievement in science and mathematics (Holbrook, 1990; Leung, Yung & Tso, 2002). Typically, Hong Kong students do comparatively well in maths and just above average in science compared with other developed countries. However, they are comparatively weak in solving items involving more real life problems and verbal explanations.

There have been claims that constructivist teaching approaches are not appropriate for Hong Kong classrooms as Chinese culture has emphasised more teacher-centered, transmission methods with the teacher regarded as an authority not to be questioned. Indeed, research in Hong Kong has shown that classrooms described by students as 'teacher-led' were more likely to encourage deeper level approaches to learning (Ma, 1994; Chan & Watkins, 1994).

However, Biggs (1996) has argued forcefully that, while at specific levels of abstraction cultural differences are evident, at more general levels the principles of good teaching are universal. In particular, Biggs points to the underlying constructive nature of effective teaching in both Chinese and Western classrooms. Thus in both contexts the focus of good teaching is appropriate individual and social learning activities, as advocated by both *cognitive* and/or *social constructivism*. Indeed a number of examples of successful teaching innovations based on such constructivist principles have been reported by Watkins and Biggs (1996; 2001). These include Problem Based Learning (Stokes, 2001); conceptual change (Chan, 2001; Ho, Watkins, & Kelly, 2001); computer supported collaborative learning (Chan, 2001); collaborative learning (Tang, 1996); and teacher education based on 'reflective practitioner' principles (So, 2001; Tang, 2001). Ching (2001) also showed that a shift to cognitive constructivist teaching approach led to higher order cognitive strategies and learning outcomes in an experimental class compared to a control class of Form 3 Hong Kong Chinese secondary school History students.

Research hypotheses. This paper reports the results of a small-scale experimental pre-test post-test study at a Hong Kong secondary school where a shift to a *critical constructivist* teaching approach was introduced in two of three Form 4

Economic classrooms. The following hypotheses were tested:

1) Students in the two experimental classes would report a significantly more constructivist learning environment compared to students in the control class;
2) Students in the experimental classes would show a change to significantly deeper approaches to learning economics compared to the control class; and
3) Students in the experimental classes who were more aware of the change in the learning environment would show the greater changes in aspects of deep approaches to learning. This is based on the principle that different students may perceive the same learning environment differently and it is those students who are most conscious of the change in environment whose approach to learning are most likely to change (McRobbie, Roth, & Lucas, 1997).

The two experimental classes also differed in achievement levels and we also wanted to find out if the new teaching approach was equally appropriate for both classes. The students' end of year Economics examination results were also obtained and we wanted to find out if the change of learning environment would lead to improved performance both at class and individual levels. However, as the examination questions were set at the relatively low conceptual level typical of the public examinations in Economics in Hong Kong, no strong relationship between changes in teaching and learning approaches and examination scores was predicted.

METHOD

Participants

Three classes of Form 4 Economics students, aged 15-16 years, at one Hong Kong secondary school for above average ability girls were involved in the research. Students were assigned to one of these classes due to timetabling reasons. This mixed ability class (n = 36) was chosen as the Control (C) group. Students were assigned to the other two classes (both n = 31) based on their examination results the previous year. The high achieving (E-H) and the low achieving class (E-L) were designated as the Experimental classes. Thus, the control group was intermediate between the two experimental classes in terms of prior achievement.

Instruments

A week after the experimental treatment, the new version of the CLES in Chinese which was based on the translation of Aldridge et al. (2000) was administered. The CLES consists of 30 items categorized into five scales (see Table 1). Each scale was to be answered on a five-point scale from '1 = almost never' to '5 = almost always'. References to Science in the CLES were changed to Economics for our purposes. As in the Taiwanese study, the CLES proved to be adequate for our respondents in terms of both the internal consistency reliabilities of responses to the scales (alphas ranging from .62 to .89, median alpha = .81) and item factor analysis, which generally supported the homogeneity of each scale and their discriminant validity.

A week before and a week after the teaching innovation was implemented, the Chinese version of the Learning Process Questionnaire (LPQ: Biggs, 1992) was also administered to the participants. A The LPQ consists of 36 items categorized into six scales of Surface Motivation, Surface Strategy, Deep Motivation, Deep Strategy, Achieving Motivation, and Achieving Strategy. The corresponding motivation and strategy scale can be combined to form an approach to learning. Each item of the LPQ is to be responded to using a five-point scale from '1 = never true' to '5 = always true'. The LPQ has been used many times in research in Hong Kong and China (see Biggs, 1992) and, as in this study, responses to the two surface scales have been found to have barely adequate internal consistency coefficient alphas of

about 0.50 but the other scales are much more adequate in this regard with alphas typically 0.70 or above. Extensive validity evidence for the LPQ for use with Chinese students was provided by Biggs (1992) and Watkins and Biggs (1996).

Treatment

In the second term, two of the Form 4 Economics classes were taught using a critical constructivist teaching approach by the first author while the control group was taught the same topics using the traditional 'teacher talk' method by another teacher. This traditional approach emphasised text book learning, frequent testing, and discouraged group work and independent thinking.

The constructivist teaching was implemented using a very different approach:

- Students were encouraged to give examples from their own lives or from the financial pages to explain new concepts or transfer abstract concepts into real situations.
- Students were given authentic economic problems or government policies of Hong Kong to justify the predictive power of Economics Theories in real life and to illustrate constraints in applying those theories, e.g. analysing the Hong Kong governments' budgetary policies.
- Students were encouraged to test their own ideas, guess the causes and predict the economic consequences of some daily events in Hong Kong, e.g. the effects of the SARS epidemic.
- Students were encouraged to challenge, in a friendly manner, each other's conceptualizations and ideas in the lessons: something that was quite new to them.
- Students were given opportunities to carry out cooperative learning activities by utilising group presentations and discussions inside the classroom and group research projects outside.
- Students were required to do more self-analysis, self-reflective thinking, and collection of real evidence to support ideas and reformulation of ideas by using new experiences and evidence in real situations.
- Students were asked to present their ideas before the teacher explained or students studied the ideas from the textbooks.

All three classes had identical teaching time (15 hours over a period of two months) and both teachers had similar degrees majoring in Economics although the control group teacher had less teaching experience.

Analysis

Descriptive statistics were obtained for the CLES and pre- and post-tests for the LPQ scales. MANOVA was used to test differences between the group means of the CLES scales and repeated measures MANOVA was used to test changes over time between the LPQ scale means of the groups. Regression analysis showed that co-variance analysis was not necessary as the changes that occurred were not dependent on the pre-test scores.

RESULTS

The means and standard deviations of items on the CLES and LPQ scales for each group are shown in Tables 1 and 2, respectively. The midpoint of the rating scales of the items of both theses scales is 3.0 which means that participants in the experimental group in particular were likely to agree with items on all scales except the CLES Shared Control and the LPQ's Surface Strategy scales.

One-way MANOVA performed on the CLES scales indicated statistically significant differences between the group means (Wilks Lambda = 0.78; F = 3.01; 10, 178 dfs; p = 0.002). Univariate tests showed that statistically significant ($p < .05$) group differences were found on all CLES scales bar Critical Voice and that these differences were between both the experimental groups compared to the control

Table 1.
Means and Standard Deviations (in parentheses) of CLES Scales for Experimental and Control Groups

CLES scales	Experimental Groups		
	High Achieving	Low Achieving	Control Group
Personal relevance	3.36 (0.52)	3.50 (0.42)	3.17 (0.41)
Critical voice	3.20 (0.61)	3.19 (0.65)	2.83 (0.57)
Shared control	2.37 (0.62)	2.55 (0.58)	2.33 (0.83)
Student negotiation	3.81 (0.66)	3.68 (0.48)	3.17 (0.56)
Uncertainty	3.40 (0.54)	3.38 (0.46)	3.12 (0.49)

Table 2.
Means and Standard Deviations (in parentheses) of LPQ Scales for Pre- and Post-tests of Experimental (E-H and E-L) and Control (C) Groups

LPQ scales	Pre-test			Post-test		
Group	E-H	E-L	C	E-H	E-L	C
Surface motivation	3.28 (0.58)	3.39 (0.71)	3.04 (0.58)	3.61 (0.49)	3.25 (0.54)	3.26 (0.44)
Surface strategy	2.86 (0.52)	2.77 (0.52)	2.78 (0.53)	2.74 (0.55)	2.87 (0.54)	2.96 (0.54)
Deep motivation	3.18 (0.56)	2.87 (0.69)	2.83 (0.62)	3.56 (0.40)	3.22 (0.56)	3.05 (0.50)
Deep strategy	2.94 (0.53)	2.63 (0.67)	2.72 (0.59)	3.16 (0.53)	2.88 (0.50)	2.95 (0.48)
Achieving motivation	3.32 (0.65)	2.87 (0.73)	2.70 (0.68)	3.77 (0.52)	2.97 (0.55)	3.00 (0.57)
Achieving strategy	3.09 (0.65)	2.57 (0.71)	2.29 (0.70)	3.04 (0.61)	2.74 (0.56)	2.71 (0.54)

group and that the differences were in the expected direction. The effect was particularly strong on the Shared Control scale.

The results of the Repeated Measures MANOVA on the LPQ scales are shown in Table 3. It can be seen that strong statistically significant effects were found for Group ($F = 4.73$; 10, 148 dfs; $p = .000$) and Group x Time ($F = 1.32$; 10, 150 dfs; $p = .005$). Univariate tests showed that significant ($p = .000$) group differences were found for the deep and achieving motivation and the deep strategy scales with the experimental groups (particularly the E-H) class being higher than the control groups in both the pre- and post-tests. The E-H group also showed the greatest change over time on the deep and achieving motivation and deep strategy scales. The control and E-L groups reported a shift to more achievement-oriented strategies.

Correlations between pre- and post-test change scores for the two deep approach scales of the LPQ and the CLES were found to be statistically significant ($p < 0.05$) for most of the scales with the high achieving experimental class only: Deep Motivation with both Critical Voice and Shared Control $r = 0.41$; with Student Negotiation $r = 0.39$; and with Uncertainty ($r = 0.44$) and Deep Strategy with Personal Relevance ($r = 0.37$); with Critical Voice ($r = 0.52$); and with Shared Control ($r = 0.51$).

As expected, students in the high achieving experimental class on average performed much better ($m = 72.86$) in their second term Economics examination compared to students of the control

Table 3.
Summary of Repeated Measure MANOVA of Group Means of LPQ Scales

Source	Wilks Lambda	*F*	*df*	Significance of *F*
Group	0.58	4.73	10, 148	.000
Time	0.92	1.32	5, 75	.265
Group x Time	0.72	2.67	10, 150	.005

class (m = 58.89) or the experimental low achieving class (m = 51.27). Not unexpectedly though no significant correlations were found between these exam scores and CLES, LPQ or LPQ change scores for any of the groups.

DISCUSSION

The introduction of a critical constructivist teaching approach in Hong Kong Form 4 economics classes was apparently successful as both experimental classes reported experiencing more personally relevant teaching material, greater encouragement of their own critical opinions, and a greater say in their classroom learning than did the control class. Although the effect of the shift on student approaches to learning was not very obvious, significant changes were in the desired direction: towards deeper and more meaning-oriented motivation and strategy. However, these desired changes were only found with the higher achieving class and were unrelated to academic performance.

An important clue as to why only the E-H class showed such changes comes from an examination of the correlations between changes in the LPQ and CLES scales in this class. It was those students who were most aware of the shift to a more constructivist learning environment who also reported a shift to more meaning-oriented motivation and strategies. This finding is in line with earlier research in Hong Kong mathematics classrooms (Wong & Watkins, 1996) that found high self-monitors achieve better in learning environments closer to those they prefer.

CONCLUSIONS

It seems that a critical constructivist learning environment can be implemented in contexts other than Western maths and science classrooms as typically reported in the literature. The results of this study need to be replicated in other Hong Kong classes, preferably where experiment and control groups and the teachers involved are comparable. However, the use of experimental classes with differential ability here did allow us to test the applicability to such classes. It appears that the teaching innovation was more successful with the higher ability class and in particular with students who were more aware of the learning environment. Further research should test these findings of ability differences in successful implementation before such an approach to teaching is widely implemented in Hong Kong secondary schools. Moreover, as awareness of a constructivist environment also seemed to be related to such success, making sure students are aware of the changes being made may promote the deeper level approaches learning desired. Changes in assessment which reward higher order learning outcomes may well promote such changes also.

AUTHOR NOTE

This paper is based on a reanalysis of data reported by the first author in an MEd dissertation submitted to the University of Hong Kong supervised by the second author. Correspondence about this paper should be sent to the second author at the Faculty of Education, University of Hong Kong, Pokfulam Road, Hong Kong (e-mail: hrfewda@hku.hk).

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