International Journal of Educational Research 75 (2016) 76–87

Contents lists available at ScienceDirect

International Journal of Educational Research

journal homepage: www.elsevier.com/locate/ijedures

# Mainland Chinese students' conceptions of learning science: A phenomenographic study in Hebei and Shandong Provinces

Zhanqiang Zhao*, Gregory P. Thomas

*Department of Secondary Education, University of Alberta, Edmonton, Alberta T6G 2G5, Canada*

ARTICLE INFO

*Article history:*
Received 12 April 2015
Received in revised form 20 November 2015
Accepted 30 November 2015
Available online 14 December 2015

*Keywords:*
Conceptions of science learning
Phenomenography
Mainland Chinese students

ABSTRACT

Mainland China has over 100 million secondary students and they are successful in international science comparisons. However, there is little empirical research into Mainland Chinese students' conceptions of science learning. The study analyzed data provided by ninety-six students from ten secondary schools in two provinces in northern China. Seven categories of conceptions of learning science emerged from the phenomenographic analysis: 'listening to the teacher,' 'attending to exams,' 'memorizing,' 'understanding,' 'doing problems,' 'hard work,' and 'improving oneself.' Three of the seven categories, i.e., 'listening to the teacher,' 'attending to exams,' and 'hard work,' are not found in the literature of conceptions of learning. These three categories of conceptions of learning are reflections of Confucian heritage Chinese culture that values hard work, advocates respect for teachers, and that holds a long history of imperial examinations. The outcome space of the conceptions of learning is proposed as a holistic structure in which the seven categories of conceptions of learning share equivalent positions. This is in contrast to the hierarchical structures commonly found in the literature. The variation in conceiving science learning among the participants resides in the two or more subcategories of each of the seven categories. The implications for educational reform and school practices are discussed.



## 1. Introduction

Mainland China has a yearly enrolment of approximately one hundred and one million secondary school students (UNESCO, 2008). International comparisons of academic performance report that they rank highly in reading, math and science (OECD PISA, 2010a; Su, Su, & Goldstein, 1994; Wang, 1998; Ye, Skoog, & Zhu, 2000). Although it seems that school science education in Mainland China is successful, some scholars (e.g., Liu, 2006; Murphy, 1987; Samuelowicz, 1987; Su et al., 1994) suggest that Mainland Chinese students are characterized by an emphasis on rote learning. Bao et al. (2009) found that Chinese students are good at remembering and recalling scientific knowledge and at employing content-based problem solving skills, but less satisfactory at scientific and creative reasoning. More evidence is required to understand better how Chinese students learn science, to better understand the apparent contradiction between Chinese students' success in learning science and this reported predominant reliance on memorization processes (Biggs, 1996; Chan & Rao, 2009). It is debatable what standards should be used to evaluate the results of science learning, nevertheless, students' conceptions of learning and their accounts of their processes of learning science will help us understand further how they learn science.

* Corresponding author.
*E-mail addresses:* zhanqian@ualberta.ca (Z. Zhao), gthomas1@ualberta.ca (G.P. Thomas).

http://dx.doi.org/10.1016/j.ijer.2015.11.008
0883-0355/

Conceptions of learning have been found to be effectively associated with students' approaches of learning and their learning outcomes (Burnet, Pillay, & Dart, 2003; Cano, 2005; Yang & Tsai, 2010), and originate from their daily experiences of learning (Entwistle & Peterson, 2004; Thomas, 2002, 2006). Conceptions of learning have been widely studied but no research is evident that reports on Mainland Chinese secondary students' conceptions of science learning. Thomas (2002, 2012) proposed that students' learning environments and their cultural values would affect their conceptions of learning. Thus, Mainland Chinese secondary students may have conceptions of learning that are different from those found in the predominantly Western literature on such conceptions.

Marton and Booth (1997) described the set of related categories developed from a phenomenographic study as the outcome space. The outcome space represents the researcher's analysis and description of the variation in a group of individuals' accounts of their ways of experiencing a phenomenon. Many scholars, such as Alsop and Tompsett (2006),Reed (2006), Richardson (1999), and Samuelowicz and Bain (1992), have suggested that outcome spaces should be hierarchical. Marton and Booth (1997) defined a hierarchical outcome space as each successive category being a more complex way of experiencing the phenomenon. Åkerlind (2002) used the term 'comprehensive' to define a hierarchy in which a lower category is less comprehensive than a higher category. For example, Säljö's (1979) and also Marton, Dall'Alba, and Beaty's (1993) first three categories are often regarded as being quantitative or reproductive, while Säljö's last two and Marton et al.'s last three categories are often regarded as being qualitative or transformative. Marton (1981) claimed that more complex experiences reflect a higher level, or a more 'authorized' view of the world, or more advanced cultural development (p. 184).

However, some scholars such as Marton, Dall'Alba, and Tse (1996), Marton, Watkins, and Tang (1997), Tynjälä (1997), and Watkins and Regmi (1992), have contended that the outcome space is not necessarily hierarchical. Marton et al. (1996) found that memorization and understanding were intertwined for Chinese participants and concluded that memorization was not necessarily a lower element of an outcome space than understanding with respect to studies undertaken in societies reflecting Chinese culture. In addition, for some participants, understanding was taken to be the sum of all the pieces of knowledge that are remembered or memorized (Marton et al., 1996, p. 4). The influence of culture on students' conceptions of learning and the lack of hierarchical structure of the outcome space in some cases is evident in several studies. For example, Watkins and Regmi (1992) argued that the conception of learning as 'changing as a person' reflected Nepalese cultural and religious traditions and did not represent the most sophisticated level in an outcome space for the participants in their study. Tynjälä (1997) observed that the seven conceptions of learning of a representative sample of Finnish students did not define a clear hierarchy. Marton et al. (1997) in their study of high school students in Kong Kong maintained that it would be inappropriate to assign 'acquiring' to a lower level than 'applying' because the notion of acquiring knowledge at times focuses on application of knowledge to further refine one's understanding, which is considered a deep approach. These findings support Åkerlind (2005) who suggested that "the structure of an outcome space need not always take the form of a linear hierarchy of inclusiveness; branching structures or hierarchies are also a possibility" (p. 329).

No research is evident that reports on Mainland Chinese secondary students' conceptions of science learning. However research about Confucian-heritage-culture (CHC) students is not sparse. Li (2001) examined conceptions of learning of 83 Chinese scholars and 100 undergraduate students and identified two categories of conceptions, 'Seeking Knowledge' and 'Achievement. 'Seeking knowledge' refers to Chinese learners' experiences of actively seeking to learn on their own; and 'achievement' refers to seeking to experience socially significant achievements such as "achieving a scientific breakthrough, becoming a respected leader or a nationally acclaimed artist" (p. 121). Under 'seeking knowledge' there was a sub-category called hao xue xi (好学习), heart and mind for wanting to learn, that Li claimed to be an important quality for Chinese learners to develop and reflect. The quality of heart and mind for wanting to learn, according to Li, is the quartet of diligence, endurance of hardship, steadfastness, and concentration. Pratt (1992) identified four qualitatively different conceptions of learning from interviews of sixty Chinese scholars. Learning was understood as, the acquisition of knowledge or skill from others, a fulfillment of responsibility to society, a change in understanding of something external to self, and a change in understanding one's self. Tsai (2004) studied one hundred and twenty Taiwanese high school students' conceptions of learning science and developed seven categories: learning science as memorizing, preparing for tests, calculating and practicing tutorial problems, the increase of knowledge, applying, understanding, seeing in a new way. He suggested that the 'memorizing', 'testing', and 'calculating and practicing' constituted a lower-level group, and 'increasing one's knowledge', 'applying', 'understanding', and 'seeing in a new way' were a higher-level group. He did not use the term 'hierarchical' as he did not state the relationship among the three conceptions in each group.

Research on Confucian-heritage-culture students' conceptions of learning may somewhat suggest how Mainland Chinese secondary students perceive of and experience learning science, however, the necessity still exists to investigate directly this student population's conceptions of learning. In addition, whether the outcome space is hierarchical or not is an issue that needs to be examined in light of the analysis of data collected first-hand. Therefore the aim of this study was to explore the conceptions of learning science from a sample of science students from the People's Republic of China.

## 2. Methodology

Phenomenography (Åkerlind, 2002; Marton, 1981; Säljö, 1996; Svensson, 1997) was the methodology employed that aimed at description, analysis, and understanding of Mainland Chinese students' science learning experiences. Phenomenography provides a way of examining the collective human experience of a phenomenon holistically, while at the same time enabling a