

ABSTRACT

ROBERTSON, LAURA ELIZABETH. *Autonomy and Self-Determination Theory in Different Contexts: A Comparison of Middle School Science Teachers' Motivation and Instruction in China and the United States.* (Under the direction of Dr. M. Gail Jones.)

This study examined factors that contribute to Chinese and United States middle school science teachers' perceptions of autonomy support. Autonomy is one component of self-determination theory and has been associated with intrinsic motivation. The study used a mixed methods design including quantitative data collected through an online survey and qualitative data collected through open-ended interview questions.

The online survey consisted of four assessments related to teachers' self-determination, perceptions of constraints at work, perceptions of students' self-determination, and level of autonomy support for students and allowed for the testing of the structural model developed by Pelletier, Seguin-Levesque, and Legault (2002). Exploratory factor analysis (EFA) of responses for the combined teacher sample ($n = 201$) was carried out for each of the survey assessments. Significance testing for Chinese ($n = 107$) and U.S. ($n = 94$) teachers, based on the factors resulting from EFA, revealed significant differences in teachers' self-determination and perceptions of constraints at work. No significant differences were found for teachers' perceptions of students' self-determination or level of autonomy support for students. Multiple regression was used to predict teachers' autonomy support for students. For the Chinese teachers, perceptions of constraints at work, teachers' self-determination, and teachers' perceptions of student motivation were found to significantly predict teachers'

autonomy support. For the U.S. teachers, teacher motivation was the only significant predictor of teachers' autonomy support.

A sub-sample of the Chinese and U.S. science teachers (n = 19) were interviewed about their perceived levels of autonomy support, constraints at work, and their students' self determination. The analyses of the interviews showed that teachers in both countries reported that autonomy was important to their motivation and the quality of instruction they provided to students. Teachers from the two countries differed in their satisfaction with current levels of autonomy and reported different constraints on teaching science related to materials, lab space, curriculum standards, and assessment.

Autonomy and Self-Determination Theory in Different Contexts: A Comparison of Middle School Science Teachers' Motivation and Instruction in China and the United States

by
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BIOGRAPHY

Laura Robertson was born on November 18, 1977 in Johnson City, Tennessee to her parents, Lee and Judith Robertson. She and her older sister, Leanna, grew up in the small town of Jonesborough and attended University School on the campus of East Tennessee State University. Laura graduated from University School in 1995 and went to the University of Tennessee, Knoxville to pursue a degree in biology. While at UTK, Laura enjoyed many wonderful experiences such as catching spiders in the desert, floating along the Mississippi River, and camping on barrier islands off the coasts of South Carolina and Georgia. She graduated in 2000 with a Bachelor's degree in Biology.

Based on her enjoyment of science, the outdoors, and experiences working as a counselor at Buffalo Mountain Camp, she decided to enter the Master's of Education program at UTK. Her supervisor, Dr. Kristen Rearden, supported and encouraged Laura through the program and remains one of her role models. Upon graduating in 2001 with her master's degree, Laura returned to University School to teach middle school science. After six challenging and rewarding years, she decided to take a two-year leave of absence to work on her doctorate in science education. Laura moved to Raleigh in 2007 to attend North Carolina State University. She found the science education program challenging and motivating, but she learned more outside of the classroom during her work as a graduate assistant with Dr. Jones. Laura looks forward to her future in science education.

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CHAPTER ONE: INTRODUCTION

The current global environment of education is one of standardization and accountability (Delandshere & Petrosky, 2004), which may have damaging effects on the intrinsic motivation, quality of instruction, and job satisfaction of teachers. In the United States, the *No Child Left Behind* assessment program typifies the increase of governmental control of education through high-stakes testing. In the United States, *No Child Left Behind* has resulted in a “narrowly defined accountability and standards movement” (Bushnell, 2003, p. 252). Unfortunately, “most teachers today (as in previous generations) are outsiders to the major decision-making processes that drive classroom practices” (Bushnell, 2003, p.270).

Similar accountability movements are occurring in other countries such as Canada (McDonald, 2002), the Netherlands (van Veen, Slegers, Bergen, & Klaassen, 2001), Australia and New Zealand (Delandshere & Petrosky, 2004), Korea (Yeom & Ginsburg, 2007), and Jordan (Mustafa & Cullingford, 2008). In Canada, the Achievement Testing Program has increased standardization of teaching methods for high school subjects (McDonald, 2002). In the Netherlands, the government has exerted increased control over teaching through “new national student qualification structures” (van Veen, et al., 2001, p. 176).

Educational reform focused on standardization can result in a decrease in teacher autonomy (Anderson, 1987), and can alter the climate of education (Bushnell, 2003). Autonomy is a central component of intrinsic motivation (Deci & Ryan, 1985). According to Deci and Ryan (1985), the intrinsic motivation of teachers can influence their quality of

instruction and job satisfaction. Research is needed to understand the impact of standardization in education on teacher autonomy as it relates to intrinsic motivation, job satisfaction, and instructional practice. Given the global nature of reform trends based on standardization and the importance of autonomy for teacher motivation and instruction, international examination of the effects of teacher autonomy is crucial for understanding the long-range impacts of standardization on student motivation and learning.

Theoretical Framework

Self-determination theory. According to self-determination theory (SDT), individuals are intrinsically motivated by three basic psychological needs: autonomy, competence, and relatedness (Deci & Ryan, 1985). Autonomy is the freedom to make choices in accordance with one's sense of self (Deci, 1971; Ryan & Deci, 2000). Competence refers to one's ability to effect one's environment (Deci & Ryan, 1985). Relatedness refers to the relationship one has with surrounding groups of people (Deci & Ryan, 2000).

Self-determination theory posits that these needs affect psychological growth and development, and consequently, human behavior. Satisfaction of these needs in an individual results in creative and engaged interaction with tasks; conversely, if these needs are not met, an individual will exhibit apathy, alienation, and reduced well-being. Tasks that meet the individual's needs of autonomy, competence, and relatedness are more intrinsically motivating.

Research on SDT has explored environmental conditions that affect needs satisfaction of students and teachers (Black & Deci, 2000; Pelletier, Seguin-Levesque, & Legault, 2002). Teachers with more autonomy are more likely to use instructional methods that are

supportive of student autonomy (Deci, Spiegel, Ryan, Koestner, & Kauffman, 1982; Pelletier, et al., 2002), thereby improving the motivation and learning of students (Black & Deci, 2000; Deci, Vallerand, Pelletier, & Ryan, 1991).

Cultural differences in autonomy. The cultural theory of individualism-collectivism describes identity of self that is based on relationships with others (Triandis, Bontempo, Villareal, Asai, & Lucca, 1988). People experience different levels of comfort in autonomous environments based upon the identity of self as independent or interdependent with a social group resulting from East/West cultural differences, (Chiu, Hong, & Dweck, 1997; Cordova & Lepper, 1996; Haidt, Koller, & Dias, 1993; Iyengar & Lepper, 1999). People in Western cultures have an independent self-construal versus people in Eastern cultures who have interdependent self-construal (Markus & Kitayama, 1991). Persons with independent self-construal assert their individuality through choice while persons with interdependent self-construal solidify their membership in a group by making choices that meet the beliefs of the larger group (Iyengar & DeVoe, 2003; Markus & Kitayama, 1991).

It is theorized that differences in individuals' comfort level and need for autonomy may vary according to cultural differences in identity of self (Iyengar & DeVoe, 2003). Studies examining cultural differences in perceived levels of autonomy and their effects on motivation are limited, but differences have been found in children from Eastern and Western cultures (Bao & Lam, 2008; Iyengar & Lepper, 1999).

Purpose

The purpose of this study was to examine factors that contribute to Chinese and United States middle school science teachers' perceptions of autonomy support. The study

tested Pelletier, Seguin-Levesque, and Legault's (2002) model for China and the United States with samples of middle school science teachers (Figure 1). Information specific to science instruction was collected through open-ended interview questions. The results of the study by Pelletier et al. as well as the constructs described in the research questions are discussed in further detail in Chapter 2.

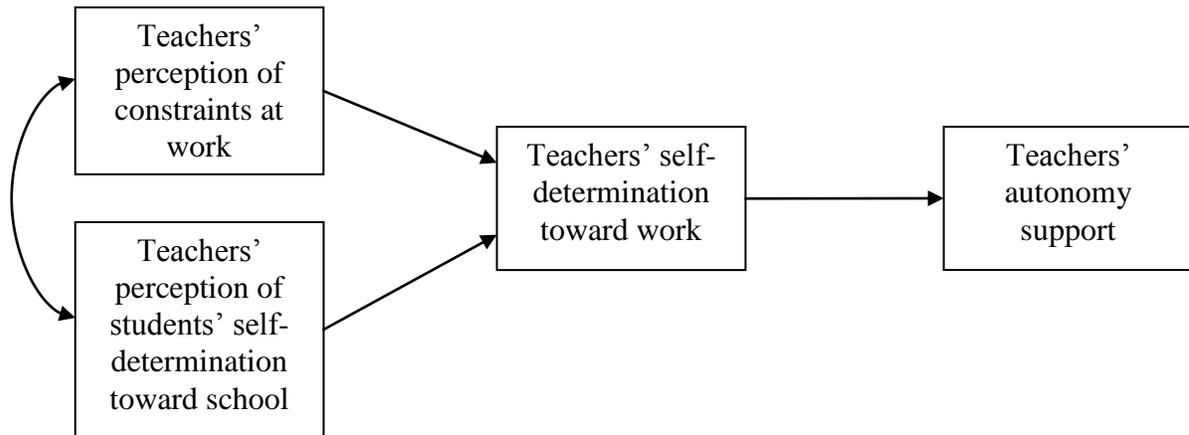


Figure 1. Structural Model Developed by Pelletier et al. (2002)

Research Questions

1. Do middle school science teachers in China and the United States differ in their perceptions of constraints at work?
2. Do middle school science teachers in China and the United States differ in their perceptions of students' self-determination toward school?
3. Do middle school science teachers in China and the United States differ in their self-determination toward work?

4. Do middle school science teachers in China and the United States differ in their levels of autonomy support?
5. Does the structural model of indicator variables developed by Pelletier et al. (2002) predict middle school science teachers' levels of autonomy support in China and the United States ?
6. Are there differences in middle school science teachers' reported instructional practices in China and the United States?

Study Variables and Terminology

Autonomy. According to Deci and Ryan (2000), “autonomy refers to volition” (p. 231). Individuals with autonomy have the “capacity to choose behaviors based on inner desires and personal perceptions” (Deci, 1980, p. 5). This freedom or independence to make choices is also referred to as self-determination and is the foundation of self-determination theory (Deci & Ryan, 1985, 2000; Ryan & Deci, 2000).

Middle school teacher. Due to differences in school organization and grade levels across the countries of interest, middle school teachers are defined as those teachers of students ages 10-14. In China, these teachers are referred to as *junior secondary teachers*.

Teachers’ autonomy support. Teachers’ autonomy support is defined as the extent to which teachers support the autonomy of their students. Teachers that exhibit high autonomy support might provide students with opportunities to make choices regarding the learning or encourage students to search for solutions to their own problems. In contrast, teachers that are highly controlling with their students are unlikely to provide choices to students regarding their learning (Deci, Schwartz, Sheinman, & Ryan, 1981; Reeve, Bolt, & Cai, 1999).

Teachers’ perceptions of constraints at work. Constraints at work refers to the pressures from administrators, colleagues, students, parents, and school curriculum that can influence teachers’ decisions regarding their work (Pelletier, et al., 2002). The study variable is teachers’ perceptions of these work-related constraints.

Teachers’ perceptions of students self-determination toward school. Students’ self-determination toward school refers to the level of motivation that students have for going to

school. The study variable is defined as teachers' perceptions of the level of student motivation for going to school (Vallerand, Blais, Briere, & Pelletier, 1989; Vallerand, et al., 1992).

Teachers' self-determination toward work. Teachers' self-determination toward work is defined as the level of motivation of teachers toward their jobs (Blais, Lachance, Vallerand, Briere, & Riddle, 1993; Tremblay, Blanchard, Taylor, Pelletier, & Villeneuve, 2009)

CHAPTER TWO: REVIEW OF LITERATURE

Introduction

International comparisons and concerns regarding teacher autonomy are not new to education. Indeed, in 1962, Lewis compared science education in England, the United States, Western Germany, and the Union of Soviet Socialist Republics (U.S.S.R.). Within his description of the strengths and weakness of each educational system, Lewis remarks on the autonomy of English science teachers by stating, “in general, [he] is given complete freedom to present his subject as he wishes” (Lewis, 1962, p. 141). His description of extreme teacher autonomy is in sharp contrast to the cautionary tones of other writers and researchers of the early 1970’s (Berg & Spinelli, 1974; Darland, 1970; Paton, 1970; Samuels, 1970). Berg and Spinelli (1974) describe “contemporary threats to teacher autonomy” (p. 230); Darland (1970) and Patton (1970) describe the struggle for teachers to attain professional status in the United States and Canada; and Samuels (1970) describes the inverse relationship between school size and elementary teacher autonomy.

Although historical concerns regarding teacher autonomy and international comparisons have existed, these concerns have new relevance and importance in the current climate of reform focused on the standardization of education. Of equal concern is the increase in globalization resulting in the rapid sharing of information and ideas. In education, this may mean that the unfavorable ideas are spread just as quickly as beneficial ones. Therefore, it is increasingly important to investigate the impacts of standardization on education in different countries in order to understand its potential impacts more fully.

The Global Trend of Standardization and Accountability in Education

The purpose of standardization is “uniformity of goals, curriculum, teaching methods, and assessments” (Wills & Haymore Sandholtz, 2009, p. 1069). Standardization is often implemented as a means of improving the equity of education and frequently results in reduced teacher autonomy and increased control at the district or state level (Wills & Haymore Sandholtz, 2009). Efforts to standardize education can include high-stakes tests, pacing guides, time requirements for certain subjects, and scripted lessons. Standardization measures may result in an emphasis on transmission of knowledge (Wills & Haymore Sandholtz, 2009). Standardization should not be confused with the implementation of standards (Wills & Haymore Sandholtz, 2009). Standards refer to a common curriculum. They are frequently included in standardization efforts, which may cause some confusion regarding the difference between the two terms.

In the United States, teachers have lost considerable autonomy since the enactment of *No Child Left Behind* (NCLB) in 2001. NCLB brought standardization and accountability into the forefront of United States education and shifted power from state and local governments to national governmental control (Jones, Jones, & Hargrove, 2003). The continuing effort to homogenize the educational preparation of a large and diverse group of students has resulted in national standards and state standards across grade levels and subject areas. In accordance with these standards, assessments are in place in all fifty states to assess student progress. In the high-stakes testing environment, teachers are often left to choose between teaching to tests of basic low level knowledge or teaching for deeper meaning. In

the words of one teacher, “I don’t have a choice to deviate from this awful test preparation” (Jones, et al., 2003, p. 37).

Other countries are facing similar changes in education. McDonald (2002) describes the concerns of Canadian teachers over losses in autonomy as a result of national diploma exams. According to van Veen et al. (2001), national accountability measures in the Netherlands “dictate the content and goals of teaching and decrease the influence of teachers . . . [thereby reducing] teachers to being the ‘executors’ of ideas of others” (p. 191). Teachers in Jordan (Mustafa & Cullingford, 2008), Ethiopia (Tekleselassie, 2005), and Pakistan (Upadhyay, Calabrese Barton, & Zahur, 2005) struggle against standardization efforts that reduce teacher autonomy. Upadhyay et al. (2005) describe a case study of a Pakistani teacher dedicated to improving the impoverished lives of her students. The teacher expresses her struggles to incorporate science content relative to the health and quality of her students lives in the face of pressure from school administrators that her students do well on high-stakes tests given once at the end of the school year (Upadhyay, et al., 2005). Given the global nature of standardization and accountability in education, it is crucial to examine the potential impacts of these trends. Theory and research on human motivation and well-being can help explain and predict the consequences of reduced teacher autonomy on the field of education.

Self-Determination Theory

In self-determination theory, Deci and Ryan (Deci & Ryan, 1985, 2000; Ryan & Deci, 2000) posit that there are three psychological needs necessary for well-being and personality integration: autonomy, competence, and relatedness. These needs are the source

of individuals' desire to be self-determined in their actions. *Autonomy* is characterized by freedom or independence to make choices free from external influence. *Competence* refers to one's belief in his or her ability to affect the external environment and is closely related to the concept of self-efficacy. *Relatedness* refers to one's feelings of security and connectedness through relationships with others (Deci & Ryan, 2000). These needs affect psychological growth and development and, consequently, human behavior. Satisfaction of these needs in an individual results in creative and engaged interaction with tasks; conversely, if these needs are not met, an individual will exhibit apathy, alienation and reduced well-being. According to this theory, the extent to which a specific task meets an individual's need for autonomy, competence, and relatedness determines the individual's amount of motivation to engage in the task.

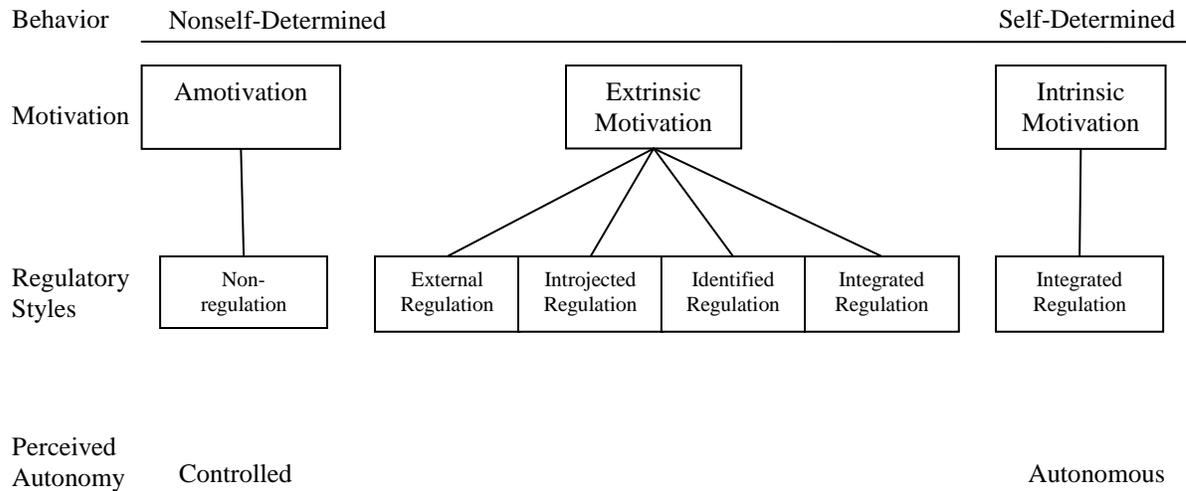
Cognitive evaluation theory. While the needs for autonomy, competence, and relatedness originate from human nature, environmental conditions can facilitate or hinder satisfaction of the needs. A subtheory of SDT, cognitive evaluation theory (CET), describes the relationship between competence and autonomy and factors that affect intrinsic motivation (Deci & Ryan, 1985). Intrinsically motivated tasks are innately rewarding; that is, the individual feels satisfied without an external reward. Intrinsic motivation, as a fundamental measure of human engagement, has been of primary interest in SDT research (Ryan & Deci, 2000). According to CET, people find different tasks intrinsically motivating based on how those tasks satisfy their individual needs to be autonomous and competent. A task that builds feelings of competence is more likely to be intrinsically motivating. Furthermore, autonomy is more critical for motivation than competence (Deci, 1980). With

the CET, it is possible to predict environmental conditions that enhance intrinsic motivation through needs satisfaction (Deci & Ryan, 1985, 2000; Ryan & Deci, 2000).

There is evidence that environmental conditions can affect needs satisfaction in different contexts such as work (Deci, et al., 2001; Gagne & Deci, 2005; Pelletier, et al., 2002), education (Black & Deci, 2000; Chirkov & Ryan, 2001; Deci, Nezlek, & Sheinman, 1981), and sports (Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005). In education, parents and teachers enhance the intrinsic motivation of students when they provide students with opportunities to be autonomous, or self-determined, in their learning (Black & Deci, 2000; Chirkov & Ryan, 2001; Deci, Nezlek, et al., 1981). In work settings, employees report increased intrinsic motivation when their work environments support their autonomy (Deci, et al., 2001; Gagne & Deci, 2005; Pelletier, et al., 2002). Most of the research on factors that build intrinsic motivation has focused on autonomy and competence. These needs have been found to exert the greatest influence on intrinsic motivation; relatedness contributes a smaller, less substantial amount (Deci & Ryan, 2000).

Organismic integration theory. Extrinsic motivation occurs in any situation in which the outcome of the task motivates engagement rather than the enjoyment of the task (Ryan & Deci, 2000). Early research on the effects of extrinsic rewards found that they diminished intrinsic motivation for tasks (Deci, 1971). Numerous studies have replicated this finding as summarized in Deci, Koestner, and Ryan's (1999) meta-analysis of studies on rewards and motivation. However, extrinsically motivating situations can have a broad range of effects on an individual. The organismic integration theory (OIT), a second subtheory of SDT, defines the continuum of extrinsic motivation (Deci & Ryan, 1985).

According to OIT, the extent to which individuals internalize and integrate the value of the extrinsically motivated task determines the extent to which they feel autonomous when engaging in the behavior. For example, if a teacher has internalized the importance of using inquiry to teach science, she might feel autonomous when following departmental requirements to teach at least one lesson using inquiry each week. Research has explored the varying degrees of extrinsic motivation and differences in how individuals regulate extrinsically motivated behavior (Ryan & Connell, 1989). OIT theory describes four levels of extrinsically motivated regulation: integrated regulation, identified regulation, introjected regulation, and external regulation that differ in the level of self-determination, or autonomy, of the individual (Deci & Ryan, 1985, 2000; Ryan & Deci, 2000). Figure 2 shows the four regulatory styles that can occur from extrinsic motivation. Along the continuum of self-determination, extrinsic motivation resides between amotivation and intrinsic motivation. Amotivation describes people who do not act or whose actions are not purposeful (Ryan & Deci, 2000).



Adapted from "Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being" by R. M. Ryan and E. L. Deci, 2000, *American Psychologist*, 55(1), p. 72.

Figure 2. The Self-Determination Continuum

Integrated regulation is the most autonomous form of extrinsically motivated regulation; the value of the task is fully integrated with the values of the individual. It differs from intrinsic regulation only because the individual engages in the task because of the value of the outcome rather than enjoyment of the task. Identified regulation is perceived as slightly less autonomous than integrated regulation; the values of the task are not as integrated into the individual's values. These two forms of regulation are sometimes combined to form an autonomous motivation composite (Ryan & Deci, 2000).

Introjected and external regulation sometimes are combined to form a controlled motivational composite (Ryan & Deci, 2000). Introjected regulation describes an individual who engages in a behavior in order to receive feedback about his or her worth. The feedback may be positive or negative. The least autonomous mode of regulation is external regulation.

In this case, an individual is acting only to avoid a punishment or to earn a reward (Ryan & Deci, 2000). These forms of external motivation are perceived by the individual as controlling rather than self-determined.

Without a doubt, the four types of extrinsically motivated regulation vary greatly and impact feelings of self-determination in very different ways. The levels of autonomy in integrated or identified regulation are much greater than those of introjected or external regulation. In educational and work settings, there frequently are tasks that must be completed because of the importance of the outcome rather than the enjoyment of the task. The crucial difference is how the individual identifies with the value of the task. In the case of teacher autonomy, the greatest benefit occurs when teachers complete a task because it has more value to them, causing them to feel more autonomous in their engagement.

Before discussing the influence of autonomy on motivation and well-being in specific educational contexts, it is important to note that fulfillment of the needs for autonomy, competence, and relatedness must be simultaneously satisfied in order to bring about optimal motivation in an individual. According to SDT, satisfying the need for autonomy without competence or relatedness (or any other combination thereof) would not achieve the desired outcomes of psychological well-being, personal growth, and motivation (Ryan & Deci, 2000). Both competence and relatedness have important roles in teaching. Competence and teachers' feelings of self-efficacy have tremendous impacts on education and receive considerable attention in research. The need for relatedness is less understood, and additional research in educational contexts is warranted given the unique qualities of teacher relationships with a number of groups (e.g. students, peers, administrators, parents, and

community). The need for relatedness has been shown to impact individual's comfort level in situations of choice (Iyengar & DeVoe, 2003; Iyengar & Lepper, 1999).

Cultural Factors Related to Autonomy

Cultures differ in the amount of emphasis placed on individual versus collectivist goals (Hofstede, 2001; Triandis, et al., 1988). Individualism and collectivism affect numerous aspects of society including family structure, personality, behavior, language, work, education, and politics (Hofstede, 2001). In individualist cultures, the goals of the individual are given greater emphasis than the goals of the collective (Iyengar & DeVoe, 2003; Triandis, et al., 1988). This has implications on moral development. In individual rights-based cultures, the rights of the individual are the primary goal while in interdependent duty-based cultures, emphasis is placed on one's relationship to other members of the group (Iyengar & DeVoe, 2003).

People in the U.S. typically rank very high, if not the highest, in measures of individualism (Hofstede, 2001; Iyengar & DeVoe, 2003; Triandis, et al., 1988). Among people in the U.S., "personal freedom of choice and individual responsibility" (Iyengar & DeVoe, 2003, p. 136) are stressed in contrast to the focus on "social duties and harmony" (p. 136) among members of collectivist cultures. Other countries that typically score high on measures of individualism are Australia, Canada, and Great Britain (Hofstede, 2001). While the United States is a prototypical example of individualism, China is a prototypical example of collectivism (Triandis, et al., 1988). Other Asian countries including South Korea, Taiwan, and Singapore and countries in Africa and Latin America are also associated with collectivism (Hofstede, 2001).

Markus and Kitayama (1991) describe the connections between individualism and collectivism and Western and Eastern cultures in individual self-construal. In Western culture, typical of the United States and Western Europe, the influence of individualism results in “a faith in the inherent separateness of distinct persons” (Markus & Kitayama, 1991, p. 226). Consequently, members of individualist cultures define themselves as separate and unique, promote their own goals, and derive self-esteem from their ability to express themselves. In contrast, the influence of collectivism in Eastern culture, typical of Asia, Africa, Latin America, and Southern Europe, results in an emphasis on “the fundamental connectedness of human beings to each other” (Markus & Kitayama, 1991, p. 227). Members of collectivist cultures define themselves through connections to a social group, promote the goals of others, and derive self-esteem from their ability to preserve harmony within the social group.

Culture and Research on Self-Determination Theory

Research linking SDT to culture has provided some evidence of the influence of individualist and collectivist culture on autonomy. In a study of elementary students, Iyengar and Lepper (1999) examined the influence of Eastern/Western culture on autonomy, motivation, and performance. Students of European American and Asian American backgrounds were divided into three groups. In the first group, the students were allowed to select an activity on which to work. In the second group, students were assigned an activity by the experimenter. In the third group, students were assigned an activity by their mothers. The Asian American students had the highest levels of motivation and performance when the task was assigned by their mothers. The European American students had the highest level of

motivation and performance when they were allowed to select the activity. Both groups of students had the lowest levels of motivation and performance when the activity was selected for them by the experimenter.

In a related study, Iyengar and Lepper (1999) examined the role of peer groups on motivation and performance of fifth graders. Again, students were divided into three groups. In group one, students made personal choices. In group two, choices were made for students by fifth grade students in another class. In group three, choices were made for students by their classmates. Similar to the findings of the first study, Asian American students were more engaged and motivated when their choices had been made by their classmates while European American students were more engaged and motivated when they made personal choices. The results of these two studies suggest that for members of Eastern cultures personal choice may not be as important to motivation and performance as situations in which parents or peers make the decision for them (Iyengar & DeVoe, 2003; Iyengar & Lepper, 1999).

Alternative explanations of the results of the studies by Iyengar and Lepper (1999) have been offered by Katz (2007) and Deci and Ryan (2000). Both explanations involve considering the broader context of the choice situations in light of the psychological need for relatedness. Whereas the explanations by Iyengar and Lepper (1999) focused solely on the need for autonomy, the alternative explanations include consideration of the individual's relatedness to other people. Katz (2007) states the following:

In contexts with strong collectivist and hierarchical orientations –typical of students from certain ethnic groups –choice can easily threaten the sense of

relatedness and belonging to one's in-group, as well as the need to be appreciated and loved by important authority figures. (p. 438)

In a similar argument, Deci and Ryan (2000) maintain that there can be differences in how autonomy is expressed in different cultures. They argue that members of Eastern cultures “may feel more volitional and autonomous when endorsing and enacting values of those with whom they identify” (p. 247). A study of 60 Chinese elementary students found evidence that the relationship between the child and the person making the choice was an important factor in the students' motivation (Bao & Lam, 2008). The authors hypothesized that the results they observed might have been due to the fact the children had internalized the decisions of their mothers thereby causing them to feel autonomous when their mothers' made choices for them (Bao & Lam, 2008).

Other studies have supported the theory of self-determination across different nationalities. In a study of Bulgarian and U.S. factory workers, the same model of predictor variables for needs satisfaction, motivation, and well-being fit the data from both countries; however, there was some variation in the strength of the relationships between some parts of the model between the two countries (Deci, et al., 2001).

Chirkov, Ryan, Kim, and Kaplan (2003) examined the extent to which individuals from the countries of Korea, Russia, Turkey, and the U.S. vary in their internalization of different cultural practices. They found significant differences in internalization between and within country samples; however, the data suggested that a higher degree of internalization was positively associated with feelings of well-being in all of the countries. These findings are consistent with SDT which posits that fulfillment of the needs for autonomy, competence,

and relatedness are basic psychological needs for all individuals (Deci & Ryan, 2000; Ryan & Deci, 2000).

Chirkov and Ryan (2001) examined the relationship between autonomy support by parents and teachers and the well-being and academic motivation of high school students using participants from Russia and the U.S. Russia was selected for the study because previous studies have documented the culture as more authoritative. It was thus hypothesized that students in Russia would perceive parents and teachers as more controlling. Data supported this result with Russian students reporting parents and teachers as being significantly more controlling than U.S. students. Consistent with SDT, however, perceived autonomy-support predicted greater well-being and academic motivation for Russian and U.S. students (Chirkov & Ryan, 2001).

A study of high school students' perceived autonomy support in physical education classes included participants from Britain, Greece, Poland, and Singapore (Hagger, et al., 2005). For all of the countries except Poland, perceived autonomy support was found to be a significant predictor of how students spent their leisure time. The authors suggested that the findings for Poland might have been a result of the significantly older age of the sample participants or the low perceptions of autonomy support (Hagger, et al., 2005).

Research on Teacher Autonomy

Diminishing autonomy can prevent teachers from controlling the basic aspects of their daily work. SDT provides a framework for evaluating diminishing teacher autonomy and predicting its effects on motivation, instructional methods, student learning, professionalism, and teacher retention. Teachers who perceive the school climate as

controlling are more likely to have negative feelings and decreased motivation toward teaching (Pelletier, et al., 2002). In a study of more than 500 workers in the United States and Bulgaria, work climate and the extent to which it reduced or supported autonomy was found to affect the engagement, anxiety, and self-esteem of employees (Deci, et al., 2001). Workers who did not feel supported by supervisors and managers reported significantly lower levels of need satisfaction (Deci, et al., 2001). Lower need satisfaction, in turn, predicted significantly higher levels of anxiety. In contrast, higher need satisfaction correlated to higher self-esteem and motivation toward work.

Instructional methods. Teacher autonomy affects the instructional methods that teachers use. Teachers with less autonomy and less self-determined motivation are less likely to support autonomy in their students (Deci, et al., 1982; Pelletier, et al., 2002; Sheldon & Biddle, 1998). In one experimental study, teachers were subjected to differing levels of administrative pressure (Deci, et al., 1982). One group of teachers was told that their role was to facilitate student learning of a task while the second group was told their role was to ensure that students learned how to complete the task. Teachers who were held accountable for the performance of their students asked more controlling questions, made more directive statements, and spent more time talking than teachers who were instructed to focus on facilitating learning (Deci, et al., 1982). In a self-report study, teachers who reported less autonomy in their work environment and lower levels of self-determination toward their work were less likely to support the autonomy of their students during learning (Pelletier, et al., 2002).

In case studies of high school science teachers, teachers with more autonomy used teaching strategies that were less traditional and more student-centered (Gess-Newsome & Lederman, 1995). These teachers used the textbook less and modified their teaching schedule to fit their needs. Autonomous teachers were also more mindful of students' needs in the planning and delivery of instruction. Gess-Newsome and Lederman (1995) also found that teachers with less autonomy were more likely to teach from the textbook and less likely to modify their schedule based on student learning.

Student motivation and learning. Reduced autonomy negatively affects teachers' motivation and attitude, and reduced autonomy also negatively affects student motivation and learning. The majority of research related to SDT in education has examined the factors that facilitate or impede student motivation. In general, when students perceive their teachers as more supportive of their autonomy, students have higher intrinsic motivation and perceived competence (Chirkov & Ryan, 2001; Deci, Schwartz, et al., 1981). High levels of intrinsic motivation in students also have been linked to improved learning and understanding (Deci, et al., 1991). In a study of 72 elementary students, choices provided during an educational math game had positive effects on student learning and motivation (Cordova & Lepper, 1996). Even though the choices available to the students did not impact the instructional material of the game, students who were provided with choices were more engaged, learned more, and felt more competent in their abilities.

A study of 137 college students enrolled in organic chemistry found a negative correlation between students' perceptions of the control exerted by their professors and

students' intrinsic motivation for the course (Black & Deci, 2000). Low perceptions of autonomy support from the instructor also were correlated to low academic performance.

Increased motivation does not always predict improved learning. In an experiment with undergraduate college students, all of the students read a 900-word essay, and following the essay, half of the students were given a choice about a follow up task (writing an essay or completing a crossword puzzle) and the other half were assigned one of the two tasks. Choice was found to increase students' affective engagement, but it did not have an effect on their cognitive engagement (Flowerday & Schraw, 2003). Studies suggest that the amount of autonomy granted to students affects their attitude and motivation toward learning.

Professional status and teacher retention. Teachers who are given too many directives sometimes feel like technicians rather than professionals. Poole (2008) found that power and organizational structures in school that prevent teachers from contributing to decision making activities or from acting autonomously can infringe on their professional identity. Furthermore, teachers may experience frustration with the confusing and contradictory messages they receive about their role as professionals. At the same time that teachers are extolled as critically important contributors to the education of students, they are not given the freedom to apply their skills and knowledge to the best of their abilities (Ingersoll, 2007). Lack of motivation and poor attitudes can have serious consequences on teacher retention. Teachers may leave public schools to work in private schools or charter schools where autonomy is greater (Crawford, 2001). Other teachers may leave the profession completely. Ingersoll (2001) analyzed more than 6,000 teachers' reasons for changing jobs or professions and found that dissatisfaction with the job was one of the

leading factors affecting their decision. Reasons for job dissatisfaction included lack of autonomy and support from administrators (Ingersoll, 2001). These conditions may make teachers more likely to leave their jobs by exiting through the “revolving door” described by Ingersoll (2001).

Gaps in the Research and the Proposed Study

There are two primary gaps in the research on SDT and science education in international contexts. First, there is very little research specific to science teaching and learning. Inquiry is a central component of the *National Science Education Standards* (NSES) (National Research Council, 1996, 2000). The use of inquiry requires teachers to prepare materials and schedule facilities for lab activities and fieldwork. It is unclear the extent to which the use of inquiry is impacted by teachers’ perceptions of autonomy in their work. Furthermore, SDT and previous research suggests that reduced teacher autonomy might lead science teachers to use more controlling teaching methods with their students possibly resulting in a decrease in the use of inquiry. This would be in direct opposition to the goals of the NSES. The proposed study is designed to provide insight into the relationship between middle school science teachers’ perceptions of autonomy, motivation, and instructional practices. The study is also designed to provide more insight into the job factors that affect teachers’ perceptions of autonomy and their motivation for teaching.

Second, previous research on SDT and culture has focused on the collection and analysis of quantitative data. The proposed study is designed to use a combination of quantitative and qualitative research methods. Following the collection and analysis of quantitative survey data, the researcher will conduct semi-structured interviews to gather

more in-depth responses from teacher participants. The use of a mixed methods study design will allow the researcher to make comparisons to the results of previous research as well as extend findings to address questions about why differences exist.

The Structural Model Developed by Pelletier et al. (2002)

The proposed research study is based on a study by Pelletier et al. (2002). The study involved Canadian teachers (n = 254) of Grades 1 through 12. The participants taught a variety of subjects. Participants completed four different survey assessments: *Constraints at Work*, *Perceptions of Students' Motivation*, *The Work Inventory Scale*, and *The Problems in Schools Questionnaire*. Each of the assessments corresponds to one of the variables in the model and will be discussed in more detail in Chapter 3. The authors proposed three different structural models. Using structural equation modeling, the authors determined which model had the best fit for the variables of interest. The model is shown in Figure 1. The proposed study will test the model developed by Pelletier et al. (2002) for samples of Chinese and U.S. middle school science teachers.

Implications of the Proposed Study

Teacher autonomy is particularly significant in science, because instruction is heavily dependent upon access to space, equipment, and materials needed for laboratory activities. How teachers perceive their autonomy related to their instructional practices can impact their use of these materials and, subsequently, the learning opportunities available to students. This study may provide a better understanding of the specific factors that influence science teachers related to their autonomy and the specific challenges of teaching science. Additionally, a clearer understanding of the state of U.S. teacher autonomy and factors that

affect it may help in the search for solutions to address the high rates of teacher turnover. Finally, this study may provide a better understanding of the extent to which teachers in China and the U.S. differ in their perceptions of autonomy and its influence on their motivation and instruction. A better understanding of international differences in science teacher autonomy could be a beginning step for applying findings to the design and implementation of future reform efforts.

CHAPTER THREE: METHODS

This study used a mixed methods design to collect quantitative and qualitative data from middle school teachers in China and the United States. Quantitative data was collected through an online survey to measure middle school science teachers' perceptions of multiple factors related to autonomy and motivation. The quantitative data collected and its analysis were based on the structural model developed by Pelletier et al. (2002). Qualitative data was gathered from a sub-sample of participants using a series of open-ended questions. The qualitative data was used to collect data on issues of autonomy specifically related to science instruction.

Research Questions

1. Do middle school science teachers in China and the United States differ in their perceptions of constraints at work?
2. Do middle school science teachers in China and the United States differ in their perceptions of students' self-determination toward school?
3. Do middle school science teachers in China and the United States differ in their self-determination toward work?
4. Do middle school science teachers in China and the United States differ in their levels of autonomy support?
5. Does the structural model of indicator variables developed by Pelletier et al. (2002) predict middle school science teachers' levels of autonomy support in China and the United States?

6. Are there differences in middle school science teachers' reported instructional practices in China and the United States?

Institutional Review Board Approval

This study received approval from the NC State University Institutional Review Board. Specific modifications were made to the original study design to meet IRB requirements to protect participants in China and the United States. In the consent letters and introductory statements for the survey and interview, participants were informed that they could choose not to answer any questions in the interview or on the survey. Within the online survey program, Secure Sockets Layer encryption was used to provide secure transmission of data when participants submitted their survey responses as well as when data was downloaded by the researcher. The survey was completely anonymous. Participation in the interviews was not anonymous; however, pseudonyms were used in the reporting of the data.

Participants

The participant sample ($n = 201$) consisted of middle school science teachers (teachers of students ages 10-14). Teachers were recruited from China and the U.S. based on previous research on culture as well as the historical and contemporary influence of Eastern/Western culture in each country (Hofstede, 2001; Triandis, et al., 1988). Of the sample, 107 teachers were from China and 94 teachers were from the United States.

The Chinese participants were selected through a partial convenience sample working through science education partners (university researchers) in the U.S. and China. The science education partners recruited a pool of middle school science teachers through personal contacts for participation in the survey portion of the study. The Chinese

participants completed a mixture of online and paper surveys. All teachers were from the Jiangsu and Shanxi provinces. The response rate for the Chinese survey was .49. In the United States, teachers were recruited through email by using contact information available on school websites and email lists of state science teaching associations. All US teachers completed the survey online and were from the states of Tennessee and North Carolina. The response rate for the U.S. survey was .18. The pool of teachers in China and the U.S. represents a mix of rural, urban, and suburban schools (Tables 2 and 3). At the end of the survey, teachers were asked if they would be willing to participate in the interview portion of the study.

Demographic information was collected at the beginning of the survey. Slight variations in the questions were necessary for Chinese and U.S. participants (Appendices A and C). Rather than ask Chinese teachers to report their ethnicity, science education partners and translators recommended asking participants if they were natives of the province in which they were teaching. The question on the English survey regarding type of teaching licensure was modified in the Chinese survey to ask teachers if they had a degree above the bachelor's level.

U.S. survey participants. The demographics of the U.S. participants are summarized in Tables 1 and 2. In Table 1, comparison data from a national survey of middle school science teachers, *Status of Middle School Science Teaching* (Fulp, 2002), is provided for reference.

Table 1

United States Teacher Demographics for Gender and Race (n = 94)

		Study Sample	United States
	n	Percentage	National Percentage*
Gender			
Female	79	84	74
Male	15	16	26
Race			
African American	6	6	6
Asian or Pacific Islander	0	0	1
Hispanic	0	0	3
Native American	0	0	1
White (not Hispanic)	88	94	89

Note. *Data from the *Status of Middle School Science Teaching* (Fulp, 2002).

Table 2

United States Teacher Demographics for Teaching Licensure, Certification, Years of Experience, and Teaching Community (n = 94)

	Study Sample	
	n	Percentage
Hold a Current Teaching License		
Yes	93	99
No	0	0
No Response	1	1
Certification		
Regular License	27	29
Lateral Entry	0	0
Master's	63	67
6-Year License	2	2
Ph.D./Ed.D.	1	1
NBPTS (National Boards)	1	1

Table 2 (continued)

	Study Sample	
	n	Percentage
Years of Teaching Experience		
0-10	36	38
11-20	36	38
21-30	18	19
31-40	3	3
More than 40	0	0
No Response	1	1
Teaching Community		
Rural	46	49
Suburban	33	35
Urban	15	16

All of the U.S. participants reported that they were native to the United States. The mean age of the participants was 43.45, with a median age of 43.75. The median age of teachers in the national survey of middle school science teachers was in the range of 41-50 years (Fulp, 2002). Of the teachers in the study, 68% reported that they had a master's degree or doctoral degree. In the national study of middle school teachers, 45% of the teachers reported that they had a master's degree. The mean age of the students taught by U.S. participants was 12.26. The teachers reported on the number of computers available to

students in the classroom and in the school. The mean number of computers available to students in the classroom was 2.85 and the mean number of computers available to students in the school was 89.30.

Chinese survey participants. The demographics of the Chinese participants are summarized in Tables 3 and 4. In Table 3, data from the Ministry of Education of the People’s Republic of China (2008b) on junior secondary science teachers is provided for comparison purposes.

Table 3

Chinese Teacher Demographics for Gender and Teaching Community (n = 107)

	n	Study Sample Percentage	Chinese National Percentage*
Gender			
Female	62	58	38
Male	44	41	62
No Response	1	1	0
Teaching Community			
Rural	11	10	39
Suburban	15	14	42
Urban	81	76	20

Note. *Data from the Ministry of Education of the People’s Republic of China (2008b).

Table 4

Chinese Teacher Demographics for Teaching Licensure, Highest Degree Held, and Years of Experience (n = 107)

	Study Sample	
	n	Percentage
Hold Current Teaching Licensure		
Yes	97	91
No	10	9
Highest Degree Held		
Bachelor's	14	13
Above a Bachelor's	78	73
No Response	15	14
Years of Teaching Experience		
0-10	62	58
11-20	32	30
21-30	8	7
31-40	3	3
More than 40	2	2

Fifteen percent of the Chinese teachers reported that they were natives of their teaching provinces, 12% reported that they were not native, and 73% did not respond to the question. The teachers in the Chinese sample reported a mean age of 34.55 with a median age

of 33.00. According to national demographic data on Chinese teachers, the median age of junior secondary teachers of all subjects is between 31-35 years (Ministry of Education of the People's Republic of China, 2008a). Seventy-three percent of the study participants reported degrees above the bachelor's level. The national percentage of graduate degrees for junior secondary science teachers is less than 1% (Ministry of Education of the People's Republic of China, 2008b). The mean age of the Chinese participants' students was 13.46. The mean number of computers in the classroom available to students was 2.17, and the mean number of computers in the school available to students was 114.54.

Interview participants. Of the survey participants who volunteered to participate in the interview, a random subset of 10 participants from each country was selected for the interview portion of the study. The interviews provided an opportunity to collect in-depth data responses from the participants to supplement the breadth of the survey data.

The U.S. interview participants consisted of seven females and three males. The average age of the interviewees was 38.2, and they were all European American. The teachers had an average of eight years of teaching experience. Seven of the teachers had master's degrees, and one teacher had National Board certification. Four of the teachers taught in rural communities, three taught in suburban communities, and three taught in urban communities.

Ten Chinese teachers completed the interview portion of the study. Nine science teachers worked with middle school age students and one science teacher worked with high school age students. The high school science teacher was excluded from the sample. The following descriptions and analyses are based on the nine teachers who worked with middle

school students. The sample consisted of five females and four males. The average age of the interviewees was 29.2. The teachers had an average of four and a half years of teaching experience. One teacher had a master's degree; the other eight had bachelor's degrees. Two teachers taught in rural communities; two taught in suburban communities; and five taught in urban communities.

Translation of Materials

Materials were translated using back-translation protocol. One of the surveys, the *Constraints at Work*, was received in French. Back-translation protocol was followed to translate the survey into English and then back to French. The other three surveys were available in English.

The initial translation of materials from English to Chinese was completed by a paid translator. The initial translation was then translated back to English by a second paid translator who did not have access to the original English versions of materials. Then the researcher and the second translator reviewed and discussed any differences in meaning between the original version and the back-translated version of the survey assessments. The researcher and second translator reached a consensus on the best translation of questionable areas and made the associated changes to the translated material.

Additional revisions were made to *The Problems in Schools Questionnaire* (PIS) instrument based on feedback from one of the science education partners in China. The PIS as described below, contains eight vignettes describing situations with students. The reader is asked to rate the appropriateness of given responses to the student situation. The vignettes were more difficult to translate than the items in the other instruments. For example, one

vignette involved students in a spelling group that were not performing well. Since spelling is not a part of learning the Chinese language, the story was modified to describe students learning vocabulary words. Another vignette included the phrase “the butt of jokes” which was changed to “made fun of and laughed at” in the Chinese version. In each of the vignettes, names were replaced with common Chinese names and references to specific items, like dollars, were replaced with Chinese equivalents. A complete version of the translated Chinese version of the PIS is located in Appendix D.

The discussions and revisions of translations were carried out through phone, email, and in person conversations. The revised drafts of translated materials for Chinese teachers were then piloted with two people prior to data collection to establish content validity and reliability.

Table 5 provides a summary of the research questions, data collection methods, constructs, and assessments that were used in the study.

Table 5

Summary of Research Questions, Data Collection Methods, Constructs, and Assessments

Research Question	Data Collection		
	Method	Construct(s)	Assessment(s)
1. Do middle school science teachers in China and the U.S. differ in their perceptions of constraints at work?	Survey	Teachers' perceptions of constraints at work	Constraints at Work
2. Do middle school science teachers in China and the U.S. differ in their perceptions of students' self-determination toward school?	Survey	Teachers' perceptions of students' self-determination toward school	Perceptions of Students' Motivation
3. Do middle school science teachers in China and the U.S. differ in their self-determination toward work?	Survey	Teachers' self-determination toward work	The Work Motivation Inventory
4. Do middle school science teachers in China and the U.S. differ in their levels of autonomy support?	Survey	Teachers' autonomy support	The Problems in Schools Questionnaire

Table 5 (continued)

Research Question	Data Collection		
	Method	Construct(s)	Assessment(s)
5. Does the structural model of indicator variables developed by Pelletier et al. (2002) predict teachers' level of autonomy support in China and the U.S.?	Survey	The four constructs listed above	The four assessments listed above
6. Are there differences in middle school science teachers' reported instructional practices in China and the U.S.?	Interview Questions	Instructional practices	Science Teacher Interview Questions

Survey Assessments

The survey assessments included the *Constraints at Work*, *Perceptions of Students' Motivation*, *The Work Inventory Scale*, and *The Problems in Schools Questionnaire*. Each set of instruments, in Chinese and English, were combined into one document and uploaded to Survey Monkey, an online survey program with foreign language capabilities (Appendices A and B). Introductory and conclusion sections were added to the surveys. The introductory section covered basic demographic information (Appendix A, questions 1-13, and Appendix

C). The conclusion thanked participants and invited them to email the researcher if they were interested in participating in the interview (Appendix A, Survey Conclusion).

All U.S. participants completed the survey online in one session. It was estimated that the entire online survey took approximately 30-45 minutes to complete. Data in China was collected through the online survey, electronic documents, and paper surveys. The electronic documents were collected by a science education partner, combined into a compressed file and emailed to the researcher. The researcher then entered the responses into the online survey. The paper versions of the survey were collected by a second science education partner who then entered the responses into the online survey. All survey responses were ultimately compiled in Survey Monkey. Data was then downloaded as Microsoft Excel files for analysis.

Constraints at Work. The *Constraints at Work* (Pelletier, et al., 2002) assessment consists of 21 items using a 7-point Likert scale (Appendix A, question 14). The instrument was created by Pelletier et al. for use in the 2002 study. In the 2002 study, three items were used to calculate three subscales of teaching constraints: constraints from colleagues, administrators, and school curriculum. Pelletier et al. report that exploratory factor analysis results supported the three factors. Two items had cross loadings, but each item had a loading at a significance of .30 or higher for its target factor. The reliability of the three subscales was .73. The instrument does not have a scoring guide for the other items which were included in the survey. In the original instrument, one item, “Your colleagues support the initiatives that you undertake in your teaching” was repeated on the survey. For this study, the item was only included once for a total of 20 items in the survey.

Perceptions of Students' Motivation. The *Perceptions of Students' Motivation* scale is an adaptation from *The Academic Motivation Scale* (Vallerand, et al., 1992, 1993) and consists of 28 items with a 7-point Likert scale (Appendix A, question 15). The scale measures seven subscales, each with four items. The subscales correspond to differing levels of student motivation: intrinsic motivation to know, intrinsic motivation toward accomplishment, intrinsic motivation to experience stimulation, extrinsic motivation by identified regulation, extrinsic motivation by introjected regulation, extrinsic motivation by external regulation, and amotivation. Vallerand et al. (1992) reported that exploratory factor analysis showed the subscales loaded separately with the reliability of the seven subscales ranging from .62 to .86. Pelletier et al. (2002) used the four subscales of intrinsic motivation, extrinsic motivation by identified regulation, extrinsic motivation by introjected regulation, and extrinsic motivation by external regulation to measure teachers' perception of constraints at work.

The Work Motivation Inventory. *The Work Motivation Inventory* (Blais, et al., 1993) includes items that measure motivational level toward work. The survey assessment consists of 18 items and uses a 7-point Likert scale (Appendix A, question 16). It measures teachers' motivation toward work in six subscales: intrinsic motivation, integrated motivation, identified motivation, introjected motivation, external motivation, and amotivation. Three questions relate to each subscale. The psychometric properties of the English version of the survey assessment were validated by Tremblay, Blanchard, Taylor, Pelletier, and Villeneuve (2009). Tremblay et al. used confirmatory factor analysis to support the six factor structure of the English version of the survey and found the reliability of each subscale to range from .64

to .83. Pelletier et al. (2002) used the four subscales of four subscales of intrinsic motivation, extrinsic motivation by identified regulation, extrinsic motivation by introjected regulation, and extrinsic motivation by external regulation to measure teachers' perception of students' self-determination toward school.

The Problems in Schools Questionnaire. The Problems in Schools Questionnaire (Deci, Schwartz, Sheinman, & Ryan, 1981) measures teachers' autonomy support versus control orientation (Appendix A, questions 17-24). It is composed of eight vignettes. Four items follow each vignette. Each item represents a different level of autonomy support: highly controlling, moderately controlling, moderately autonomy supportive, or highly autonomy supportive. Item responses are on a 7-point Likert scale. Deci et al. report that the internal consistency of each subscale is .63 to .80.

Open-ended Interview Questions

The open-ended interview questions were used to document teachers' perceptions of issues of autonomy and motivation specific to science instruction (e.g. lab and fieldwork, materials management, and inquiry).

In the U.S. teachers were interviewed using the Science Teacher Interview Questions (Appendix D). Interviews ranged in length from 25 to 60 minutes. Nine interviews were conducted over the phone and one interview was conducted in person. Interviews were recorded and later transcribed. A sample transcript of a U.S. teacher interview is included in Appendix H. The ten interview transcriptions were emailed to the U.S. participants in order to allow them the opportunity to provide written feedback on their answers.

Due to limited internet access on the part of the Chinese teachers, it was not possible to follow the original plan of using voice over internet software and a translator to interview the Chinese participants. Instead, the Chinese participants wrote their responses to the open-ended questions (Appendices F and G). The Chinese version of the Science Teacher Interview Questions contained additional questions to probe the interviewees as they wrote their responses. One of the science education partners in China collected and compiled the interview responses. The responses were emailed to the researcher. A translator made a recording of himself reading the interview responses aloud. The recordings were transcribed to create English translations of the interview responses. The researcher and the translator reviewed the English translations and the original Chinese documents for accuracy.

Analysis of Survey Assessments

Data cleaning and missing value replacement. After the survey data were collected, they were downloaded from Survey Monkey as a Microsoft Excel file. In the U.S., 151 teachers had participated in the survey, and 146 Chinese teachers had participated in the survey. The data were reviewed and cleaned in Excel. Participant responses were removed from the sample if the survey was not completed, teachers worked at private schools, or if the teacher had entered a single value for an entire section of the survey. After these participants were removed from the sample, means and standard deviations were calculated for each of the factors being measured in the survey. If a participant's mean response for a factor was three or more standard deviations away from the factor mean, the participant was identified as an outlier and removed from the sample. Finally, if a participant had completed the survey but had not answered some of the items, the missing values were replaced with the

participant's factor mean score. After completing these steps to clean the data and replace missing values, the data for the U.S. teachers (n = 94) and Chinese teachers (n = 107) was transferred to the statistical program SPSS.

Exploratory factor analysis. Exploratory factor analysis (EFA) was carried out on the combined sample of Chinese and U.S. teachers in order to validate the factor (or subscale) structure for each instrument for the study sample. The original instruments were validated on different samples, primarily French-Canadian and U.S. participant samples. Changes in the factor structure of survey assessments due to language translation and cultural differences have been documented in other studies (Fossati, Di Ceglie, Acquarini, & Barratt, 2001; Kitamura, et al., 2004; Ryan, Chan, Ployhart, & Slade, 1999). In the case of this study, translation from English to Chinese may have caused variations in the meaning of particular items or groups of items that resulted in changes in the factors being measured. Also, the Constraints at Work assessment was received in French, translated to English, and then translated to Chinese. This series of translations may have resulted in changes in meaning for survey items. For these reasons, EFA was carried out to determine the factor structure of the study sample.

All items for the four survey assessments were included in the EFAs. The combined sample of Chinese and U.S. teachers had a total n of 201. Therefore, the subject to item ratio was greater than 10 to 1 for the Constraints at Work and the Work Motivation Inventory, and the subject to item ratio was great than 6 to 1 for the Perceptions of Students' Motivation assessment and the Problems in Schools Questionnaire. These subject to item ratios meet the recommendations of Costello and Osborne (2005).

The EFAs were conducted using principal axis factoring. Oblique direct oblimin rotation was used because it was assumed that the factors were correlated. The number of factors for each survey assessment was determined based on a combination of measures. The Kaiser criteria was reviewed to determine the approximate number of factors to include. Following this, a scree plot of Eigenvalues was obtained. With the exception of the *Constraints at Work*, factor structures that included factors with fewer than three items were not used. The factors were named based on a review of the survey items that loaded for each factor. Factor means were calculated based on the mean of the participants' responses for all of the items in the factor.

Scale composites were computed based on the weight of each factor as determined from the factor matrix of a one-factor EFA. The equations used to compute the scale composite scores are provided below:

$$\begin{aligned} \textit{Constraints at Work} = & (.995 * \textit{Support}) + (.650 * \textit{Work with students}) - & (1) \\ & (.394 * \textit{Constraints}) \end{aligned}$$

$$\begin{aligned} \textit{Perceptions of Students' Motivation} = & (.895 * \textit{Accomplishment}) + (.721 & (2) \\ & * \textit{Enjoyment}) + (.689 * \textit{Job success}) - (.523 * \textit{Amotivation}) \end{aligned}$$

$$\begin{aligned} \textit{Work Motivation Inventory} = & (.861 * \textit{Satisfaction}) + (.793 * \textit{Identity}) + & (3) \\ & (.108 * \textit{Income}) - (.360 * \textit{Amotivation}) \end{aligned}$$

$$\begin{aligned} \text{Problems in Schools Questionnaire} = & (.762 * \text{High autonomy support}) + & (4) \\ & (.441 * \text{Moderate autonomy support}) - (.170 * \text{Controlling}) \end{aligned}$$

Significance testing. Analysis of significant differences between Chinese and U.S. teachers' for the factors and scale composites of each survey assessment were completed using independent samples t-tests. Equal variances were not assumed for the factors or scale composites. The Bonferoni Correction Adjustment was calculated to ensure that the overall chances of making a Type I error were still less than 0.05 while running multiple tests. The value was calculated by dividing 0.05 by the number of t-tests performed (18). The result was a significance level of $p < 0.00278$.

Multiple regression. The structural model developed by Pelletier et al. (2002) was made using structural equation modeling (SEM) which includes confirmatory factor analysis (CFA) as a part of the model. The results of the EFA for the study sample were different from the CFA factors in the original model; therefore, it was not possible to use SEM to analyze the relationships between the study constructs. Instead, multiple regression of the scale composites, derived from the EFAs, was used to construct a model for each country. This alternative approach to testing the model, nevertheless, revealed the extent to which the constructs of teachers' perceptions of constraints at work, students' self-determination toward school, and self-determination toward work predicted the outcome variable of teachers' autonomy support. It also tested whether the construct of teachers' self-determination toward work mediated the effects of teachers' perception of constraints at

work and teachers' perception of students' self-determination toward school as indicated by the original model.

Analysis of Open-ended Interview Questions

The responses to the open-ended interview questions were coded for themes related to instructional practices as well as constraints at work, student motivation, self-determination toward work, and autonomy support of students. The interview coding themes are listed in Table 6. Thematic patterns were analyzed across individual countries and the two countries combined. Two themes that emerged from the interviews were trust and collaboration. A sub-sample of two of the interview transcripts were coded independently by two people. The inter-rater reliability was .88 for the two coders.

Table 6

Interview Coding Themes

-
1. Constraints at work
 - a. administrators
 - b. colleagues
 - c. parents
 - d. students
 - e. materials, space, or money
 - f. school curriculum or standards
 - g. standardized testing
 - h. time
-

Table 6 (continued)

- i. class size
 - 2. Student motivation
 - 3. Student learning
 - 4. Student autonomy
 - 5. Teacher motivation
 - 6. Teacher autonomy
 - 7. Instructional practice
 - a. planning and instruction
 - b. lab activities
 - c. materials (textbooks, lab equipment, etc.)
 - d. individualizing instruction
 - e. assessment
 - 8. Trust
 - 9. Collaboration
-

The interview transcripts were read and themes were coded in the margins of the transcripts. Statements and phrases were coded with a number and letter corresponding to the list in Table 6. For example, Leslie stated, “I teach on a team with two other science teachers whom I plan with. But we all are expected to give the same, common assessments, which we design together. So, we work together on the assessments, so I don’t necessarily feel as if I’m giving somebody else’s test. I mean, we created it together.” This statement was coded for

constraints from administrators, instructional practice using assessment, and collaboration.

The codes 1a, 7e, and 9 were placed in the margin of the transcript beside the statement.

CHAPTER FOUR: RESULTS OF THE SURVEY ASSESSMENTS

Exploratory Factor Analysis

Each of the survey assessments was used to collect data related to one of the four constructs of interest in the study: teachers' perception of constraints at work, teachers' perception of students' self-determination toward school, teachers' self-determination toward work, and teachers' autonomy support. The results of the EFAs for the combined study sample ($n = 201$) for each of the survey assessments are described below. In general, the EFAs resulted in fewer factors than in the original versions of the instruments; however, the new factors were closely related to the original factor structures and the theoretical framework of the instruments.

Constraints at Work. The result of the EFA for the *Constraints at Work* was a three-factor structure (Table 7) that explained 48% of the total variance in the responses. One factor, constraints, had only two items; however, this factor structure had conceptual coherence based on the survey items. The other factors had seven and three items. The reliability of the factors ranged from .66 to .85.

Table 7

Internal Consistency Values (Cronbach alpha) and Number of Items for Constraints at Work

Factors

Factor	Alpha (n = 201)	Number of Items
Support	.85	7
Constraints	.66	2
Work with students	.78	3

The factor loadings and survey items are shown in Table 8. The seven items in the support factor relate to positive environmental support from administrators, colleagues, parents, and students, and one item relates to school curriculum. The constraints factor contains two items related to constraints on teaching, and the work with students factor contains three items related to motivating and evaluating students.

Seven items were removed from the factor structure and subsequent analyses. Six items (14.d, g, h, k, m, and p) did not have factor loadings greater than .40 for any of the factors. Item 14.n was removed from the work with students factor to improve the internal reliability of the factor.

Table 8

Factor Loadings, Item Numbers, and Items for Constraints at Work Factors

	Factor	Item	
Factor	Loading	Number	Item
Support	.77	14.s.	Your students' parents support your teaching methods.
	.74	14.r.	You are supported by your students' parents.
	.57	14.c.	You students are interested in the material.
	.56	14.b.	You feel supported by school administrators.
	.51	14.a.	It is important to cover the entire curriculum.
	.50	14.o.	It is important that your students have fun learning.
	.49	14.q.	Your colleagues support the initiatives that you undertake in your teaching.
Constraints	.73	14.f.	All the students in the class must progress at the same rate.
	.60	14.e.	You must adhere to the teaching methods of your colleagues.

Table 8 (continued)

	Factor	Item	
Factor	Loading	Number	Item
Work	-.64	14.j.	It is important that your students have good productivity.
with	-.58	14.i.	You must encourage your students to do their homework.
students	-.51	14.l.	You must regularly evaluate your students.

Factor correlations for the *Constraints at Work* factors are reported in Table 9. The constraints factor is significantly negatively correlated with the factors of support and work with students. The significant correlations between the three factors (and among factors in the other survey assessments) support the use of oblique direct oblimin rotation during the EFAs.

Table 9

Correlations for Constraints at Work Factors

Factor	1	2	3
1. Support	----	-.40**	.65**
2. Constraints		----	-.25**
3. Work with students			----

Note. **Correlation is significant at the .01 level (2-tailed).

Pelletier et al. (2002) used three subscales of constraints from administrators, colleagues, and school curriculum to indicate teachers' perceptions of constraints at work. The subscales used by Pelletier et al. were based on nine of the items in the survey

assessment. For the current study, all of the items were included in the EFA, and 12 of the 20 items were retained in the model. The constraints factor for this sample includes seven of the items that were used to calculate the subscales in the original study. The *Constraints at Work* survey assessment is not organized around the self-determination continuum (Figure 2) and does not contain a scoring guide like the other instruments; therefore, the factors of constraints, support, and work with students should not be assumed to represent a spectrum of motivation and perceived autonomy like the other instruments.

Perceptions of Students' Motivation. The EFA for *Perceptions of Students' Motivation* resulted in a four-factor structure shown in Table 10. The factors had between four and ten items with internal reliabilities ranging from .80 to .94. The model explained 67% of the total variance in the responses.

Table 10

Internal Consistency Values (Cronbach alpha) and Number of Items for Perceptions of Students' Motivation Factors

Factor	Alpha (n = 201)	Number of Items
Accomplishment	.94	10
Job success	.90	8
Amotivation	.82	4
Enjoyment	.80	4

The factor loadings and survey items are shown in Table 11. The accomplishment factor contains ten items related to students' feelings of satisfaction associated with accomplishments in school. The eight items in the job success factor relate to students' success in future career endeavors such as salary, competence, and prestige. The amotivation factor includes four items reflecting apathy toward education while the enjoyment factor includes four items that reflect pleasure in the experience of learning.

Two items (15.w and aa) did not have factor loadings greater than .40 and were excluded from subsequent analyses.

Table 11

Factor Loadings, Item Numbers, and Items for Perceptions of Students' Motivation Factors

Factor	Factor Loading	Item Number	Item
Accomplishment	.92	15.p.	For the pleasure that I experience in broadening my knowledge about subjects which appeal to me.
	.77	15.m.	For the pleasure that I experience while I am surpassing myself in one of my personal accomplishments
	.77	15.y.	For the "high" feeling that I experience while reading about various interesting subjects.
	.76	15.r.	For the pleasure that I experience when I am taken by discussions with interesting teachers.
	.71	15.t.	For the satisfaction I feel when I am in the process of accomplishing difficult academic activities.
	.69	15.n.	Because of the fact that when I succeed in school I feel important.
	.67	15.i.	For the pleasure I experience when I discover new things never seen before.

Table 11 (continued)

	Factor	Item	
Factor	Loading	Number	Item
Accomplishment (continued)	.63	15.b.	Because I experience pleasure and satisfaction while learning new things.
	.61	15.bb.	Because I want to show myself that I can succeed in my studies.
	.53	15.u.	To show myself that I am an intelligent person.
Job success	.90	15.v.	In order to have a better salary later on.
	.69	15.a.	Because I need at least a high-school degree in order to find a high-paying job later on.
	.65	15.o.	Because I want to have “the good life” later on.
	.64	15.j.	Because eventually it will enable me to enter the job market in a field that I like.
	.61	15.h.	In order to obtain a more prestigious job later on.
	.60	15.c.	Because I think that a high-school education will help me better prepare for the career that I have chosen.
	.53	15.x.	Because I believe that my high school education will improve my competence as a worker.

Table 11 (continued)

	Factor	Item	
Factor	Loading	Number	Item
Job success (continued)	.45	15.q.	Because this will help me make a better choice regarding my career orientation.
Amotivation	.78	15.s.	I can't see why I go to school and frankly, I couldn't care less.
	.73	15.z.	I don't know; I can't understand what I am doing in school.
	.61	15.e.	Honestly, I don't know; I really feel that I am wasting my time in school.
	.59	15.l.	I once had good reasons for going to school; however, now I wonder whether I should continue.
Enjoyment	.64	15.d.	Because I really like going to school.
	.61	15.k.	Because for me, school is fun.
	.59	15.g.	To prove to myself that I am capable of completing my high school degree.
	.54	15.f.	For the pleasure I experience when surpassing myself in my studies.

The correlations for the factors of *Perceptions of Students' Motivation* are shown in Table 12. The four factors are significantly correlated with one another. Amotivation is negatively correlated with the factors of accomplishment, job success, and enjoyment.

Table 12

Correlations for Perceptions of Students' Motivation Factors

Factor	1	2	3	4
1. Accomplishment	----	.68**	-.43**	.66**
2. Job success		----	-.38**	.46**
3. Amotivation			----	-.41**
4. Enjoyment				----

Note. **Correlation is significant at the .01 level (2-tailed).

When compared to the original factor structure of the *Academic Motivation Scale*, the factors for this study show a similar organization. The accomplishment and enjoyment factors contain items that were designed to reflect intrinsic motivation as theorized by SDT (Vallerand, et al., 1992, 1993). The job success factor corresponds to items designed to measure extrinsic motivation. The four items that comprise the amotivation factor are the same items that composed the amotivation subscale in the original inventory. Together the four factors represent a spectrum of motivation from intrinsic (accomplishment and enjoyment) to extrinsic (job success) to amotivation corresponding to the self-determination continuum (Figure 2).

The Work Motivation Inventory. The EFA for the four-factor model of the *Work Motivation Inventory* is summarized in Table 13. This model accounted for 65% of the total variance of the responses. The factors had between three and seven items with internal reliabilities ranging from .70 to .88.

Table 13

Internal Consistency Values (Cronbach alpha) and Number of Items for the Work Motivation Inventory Factors

Factor	Alpha (n = 201)	Number of Items
Satisfaction	.88	7
Income	.73	3
Amotivation	.70	3
Identity	.78	5

The factor loadings and individual items for the four factors are shown in Table 14. The satisfaction factor includes seven items related to feelings of satisfaction from job success and positive work experiences. The income factor is comprised of three items that relate to income, salary, and lifestyle, and the amotivation factor includes items that reflect apathy toward work. The fourth factor, identity, includes five items describing career choice as an integral part of identity and personal goals. All of the survey items had factor loadings greater than .40 and were retained in the factor structure.

Table 14

Factor Loadings, Item Numbers, and Items for the Work Motivation Inventory Factors

Factor	Factor Loading	Item Number	Item
Satisfaction	.82	16.o.	For the satisfaction I experience when I am successful at doing difficult tasks.
	.70	16.k.	Because I want to be very good at this work, otherwise I would be very disappointed.
	.62	16.h.	For the satisfaction I experience from taking on interesting challenges.
	.61	16.d.	Because I derive much pleasure from learning new things.
	.59	16.m.	Because I want to be a winner in life.
	.58	16.f.	Because I want to succeed at this job, if not I would be very ashamed of myself.
	.45	16.e.	Because it has become a fundamental part of who I am.
Income	.84	16.b.	For the income it provides me.
	.77	16.i.	Because it allows me to earn money.

Table 14 (continued)

	Factor	Item	
Factor	Loading	Number	Item
Income	.50	16.a.	Because this is the type of work I chose to do in order to attain a certain lifestyle.
(continued)			
Amotivation	.73	16.q.	I don't know, too much is expected of us.
	.64	16.l.	I don't know why, we are provided with unrealistic working conditions.
	.51	16.c.	I ask myself this question, I don't seem to be able to manage the important tasks related to this work.
Identity	-.61	16.j.	Because it is part of the way in which I have chosen to live my life.
	-.61	16.p.	Because this type of work provides me with security.
	-.55	16.n.	Because it is the type of work I have chosen to attain certain important objectives.
	-.46	16.r.	Because this job is a part of my life.
	-.44	16.g.	Because I chose this type of work to attain my career goals.

Table 15 contains the correlations among the four factors for the *Work Motivation Inventory*. Identity, satisfaction, and amotivation are significantly correlated with one another. Income is significantly correlated with identity but not with satisfaction or amotivation. The significant correlations of amotivation with satisfaction and identity are negative.

Table 15
Correlations for the Work Motivation Inventory Factors

Factor	1	2	3	4
1. Satisfaction	----	.04	-.34**	.68**
2. Income		----	.09	.20**
3. Amotivation			----	-.27**
4. Identity				----

Note. **Correlation is significant at the .01 level (2-tailed).

The factor structure for the combined study sample is closely related to the original subscales reported by Blais et al. (1993) and the underlying theoretical framework of self-determination. The items composing the success factor are similar to the items in the intrinsic motivation subscale. The factors of income and identity are similar to subscales measuring extrinsic motivation. The amotivation factor contains the same three items in the original amotivation subscale. The four factors of the EFA for the *Work Motivation Inventory* closely align with the spectrum of motivation in the self-determination continuum (Figure 2) from intrinsic motivation (success) to extrinsic motivation (income and identity) to amotivation.

The Problems in Schools Questionnaire. The EFA resulted in a three-factor structure shown in Table 16. The three factors explained 46% of the total variance in the responses. The factors had between nine and twelve items and their internal reliabilities ranged from .81 to .87.

Table 16

Internal Consistency Values (Cronbach alpha) and Number of Items for the Problems in Schools Factors

Factor	Alpha (n = 201)	Number of Items
High autonomy support	.87	12
Controlling	.81	9
Moderate autonomy support	.85	9

The factor loadings and items for three factors are shown in Table 17. The high autonomy support factor includes twelve items that describe responses on the part of the parent or teacher that encourage student autonomy in addressing problems. The items have a focus on dialogue between the students and adults, and in many of the items, the adults ask the students about how they plan to deal with particular situations. The controlling factor includes nine items in which the adult tells the student what to do or uses bribes and punishments to control student behavior. The moderate autonomy support factor also includes nine items and is an intermediate between the high autonomy support and controlling factors. Items include responses in which adults offer students specific

suggestions of how they might deal with situations. Two items (19.d and 17.b) did not have factor loadings greater than .40 and were removed from subsequent analyses.

Table 17

Factor Loadings, Item Numbers, and Items for the Problems in Schools Factors

Factor	Factor Loading	Item Number	Item
High autonomy support	.80	24.a.	Encourage her to talk about her report card and what it means for her.
	.74	21.d.	Help the group devise ways of learning the words together (skits, games, and so on).
	.68	20.a.	Ask him to talk about how he plans to handle the situation.
	.63	18.d.	Continue to emphasize that she has to work hard to get better grades.
	.61	18.c.	Tell her about the report, letting her know that they're aware of her increased independence in school and at home.
	.60	19.a.	Emphasize how important it is for him to "control himself" in order to succeed in school and other situations.

Table 17 (continued)

Factor	Factor Loading	Item Number	Item
High autonomy support (continued)	.55	23.a.	Talk to him about the consequences of stealing and what it would mean in relation to the other kids.
	.53	17.a.	She should impress upon him the importance of finishing his assignments since he needs to learn this material for his own good.
	.52	22.c.	Invite her to talk about her relations with the other kids, and encourage her to take small steps when she's ready.
	.51	23.d.	Emphasize that it was wrong and have him apologize to the teacher and promise not to do it again.
	.51	23.b.	Talk to him about it, expressing her confidence in him and attempting to understand why he did it.
	.46	19.c.	Help him see how other children behave in these various situations and praise him for doing the same.

Table 17 (continued)

	Factor	Item	
Factor	Loading	Number	Item
Controlling	.69	23.c.	Give him a good scolding; stealing is something which cannot be tolerated and he has to learn that.
	.62	24.d.	Offer her a dollar for every A and 50 cents for every B on future report cards.
	.60	20.d.	Make him miss tomorrow's game to study; soccer has been interfering too much with his school work.
	.59	17.c.	Make him stay after school until that day's assignments are done.
	.58	24.c.	Stress that she should do better; she'll never get into college with grades like these.
	.51	20.b.	Tell him he probably ought to decide to forego tomorrow's game so he can catch up in spelling.
	.50	24.b.	Go over the report card with her; point out where she stands in the class.
	.50	18.a.	Increase her allowance and promise her a ten-speed if she continues to improve.

Table 17 (continued)

	Factor	Item	
Factor	Loading	Number	Item
Controlling (continued)	.46	19.b.	Put him in a special class which has the structure and reward contingencies which he needs.
Moderate autonomy support	.85	22.b.	Talk to her and emphasize that she should make friends so she'll be happier.
	.64	20.c.	See if others are in the same predicament and suggest that he do as much preparation as the others.
	.64	21.a.	Have regular spelling bees so that Rangers will be motivated to do as well as the other groups.
	.61	17.d.	Let him see how he compares with the other children in terms of his assignments and encourage him to catch up with the others.
	.57	22.a.	Prod her into interactions and provide her with much praise for any social initiative.
	.57	21.b.	Make them drill more and give them special privileges for improvements.

Table 17 (continued)

	Factor	Item	
Factor	Loading	Number	Item
Moderate autonomy support (continued)	.54	22.d.	Encourage her to observe how other children relate and join in with them.
	.47	21.c.	Have each child keep a spelling chart and emphasize how important it is to have a good chart.
	.45	18.b.	Tell her that she's now doing as well as many of the other children in her class.

The correlations among the factors for *The Problems in Schools Questionnaire* are shown in Table 18. The factors of high autonomy support and moderate autonomy support are significantly correlated. The controlling factor has a significant negative correlation with high autonomy support, but it is not significantly correlated with moderate autonomy support.

Table 18

Correlations for the Problems in Schools Factors

Factor	1	2	3
1. High autonomy support	----	.34**	-.15*
2. Moderate autonomy support		----	-.05
3. Controlling			----

Note. *Correlation is significant at the .05 level (2-tailed). **Correlation is significant at the .01 level (2-tailed).

The original factor structure of *The Problems in Schools Questionnaire* contains four subscales, highly autonomy supportive, moderately autonomy supportive, moderately controlling, and highly controlling (Deci, Schwartz, et al., 1981). The three factors that resulted from the EFA for the combined study sample are similar. The primary difference is that the EFA included only one factor measuring control. The three factors reflect a spectrum of teachers' level of autonomy support for their students.

Significance Testing

The results of the independent *t*-tests comparing factor and scale composite means for the U.S. and Chinese teachers are shown in Tables 19 through 22. The factor means range from 2.24 to 5.82 reflecting the 7-point Likert scale for the survey items. Scale composite means range from 5.23 to 8.95. The values are higher because they were calculated using Equations 1 through 4 described in the methods section. The Bonferoni Correction Adjustment of $p < 0.00278$ was applied to test for significance.

Research Question 1: Do middle school science teachers in China and the United States differ in their perceptions of constraints at work? The U.S. and Chinese teachers differed significantly for the factors of support, constraints, and work with students (Table 19). U.S. teachers had significantly higher means for the factors of support and work with students indicating higher perceived levels of support from administrators, colleagues, parents, and students and a greater emphasis on the importance of motivating and assessing students. The Chinese teachers had a significantly higher mean for the constraints factor indicating that they perceived greater constraints on their teaching from students and colleagues.

Table 19

Perceptions of Constraints at Work for Middle School Science Teachers in China and the U.S. by Factors and Scale Composite

	U.S.	China		
	Mean (SD)	Mean (SD)		
Factor	(n = 94)	(n = 107)	<i>t</i>	df
Support	5.70 (0.67)	4.63 (1.28)	7.57*	165
Constraints	2.55 (1.26)	3.24 (1.60)	-3.67*	193
Work with students	6.15 (0.76)	4.93 (1.43)	7.65*	166
Scale composite	8.66 (1.00)	6.53 (2.34)	8.58*	147

Note. *Bonferoni Correction Adjustment $p < 0.00278$

Equation 1 was used to calculate the scale composite scores. The U.S. teachers had a significantly higher composite score than the Chinese teachers. Unlike the other surveys, the

Constraints at Work survey assessment was not constructed based on the self-determination continuum (Figure 2). Due to the differences in factor structure between the current study and the study by Pelletier et al. (2002), comparison of the construct of teachers' perceptions of constraints at work as measured by Pelletier et al. and the researcher of the current study are greatly limited. Furthermore, the scale composite scores of the current study do not clearly align with the self-determination continuum, so it is not possible to explain what a higher composite score represents. All that can be concluded from the scale composite scores is that significant differences existed for the U.S. and Chinese teachers in their overall responses to the items of the *Constraints at Work* survey assessment.

Research Question 2: Do middle school science teachers in China and the United States differ in their perceptions of students' self-determination toward school? The results of significance testing for the factors and scale composite for the *Perceptions of Student's Motivation* are shown in Table 20. The Chinese teachers had a significantly higher mean score for the factor of accomplishment indicating that the Chinese teachers perceive that their students are motivated by accomplishments in school to a greater extent than U.S. teachers. There were no significant differences for the factors of job success, amotivation, or enjoyment.

Table 20

Perceptions of Students' Motivation for Middle School Science Teachers in China and the U.S. by Factors and Scale Composite

Factor	U.S.	China	<i>t</i>	Df
	Mean (SD) (n = 94)	Mean (SD) (n = 107)		
Accomplishment	3.95 (1.12)	4.81 (1.36)	-4.89*	198
Job success	4.94 (1.38)	4.70 (1.14)	1.33	181
Amotivation	3.10 (1.20)	3.19 (1.51)	-0.46	197
Enjoyment	3.75 (1.06)	4.21 (1.37)	-2.71	196
Scale composite	8.03 (2.67)	8.92 (3.12)	-2.19	199

Note. *Bonferoni Correction Adjustment $p < 0.00278$

Equation 2 was used to calculate the scale composite scores for *Perceptions of Students' Motivation*. A higher scale composite score indicates that teachers' perceive student motivation to be closer to the intrinsically motivated and autonomous end of the self-determination continuum than a lower score. There was no significant difference in the scale composite scores for the U.S. and Chinese teachers. They had similar perceptions of the factors that motivate their students in school and the extent to which they perceive their students to be intrinsically or extrinsically motivated. The results indicate that, overall, the U.S. and Chinese teachers were similar for the construct of teachers' perception of students' self-determination toward school.

Research Question 3: Do middle school science teachers in China and the United States differ in their self-determination toward work? The results of the significance testing for the *Work Motivation Inventory* are reported in Table 21. The U.S. teachers had significantly higher means for the factors of satisfaction and identity while the Chinese teachers had significantly higher means for the factor of amotivation. There was no significant difference in U.S. and Chinese teachers' means for the income factor.

The scale composite mean scores, as calculated by Equation 3, were significantly different. A higher mean for the scale composite corresponds to a higher level of intrinsic motivation for work. The U.S. teachers had a higher scale composite mean indicating a higher level of intrinsic motivation for work. The U.S. and Chinese teachers differed significantly for three of the individual factors and the overall construct of teacher's self-determination toward work as measured by the *Work Motivation Inventory*.

Table 21

Work Motivation for Middle School Science Teachers in China and the U.S. by Factors and Scale Composite

Factor	U.S.	China	<i>t</i>	df
	Mean (SD) (n = 94)	Mean (SD) (n = 107)		
Satisfaction	5.81 (0.85)	4.83 (1.36)	6.20*	180
Income	3.80 (1.44)	4.28 (1.29)	-2.48	188
Amotivation	2.24 (1.25)	3.42 (1.28)	-6.61*	197
Identity	5.48 (0.96)	4.44 (1.13)	7.06*	199
Scale composite	8.95 (1.43)	6.91 (2.10)	8.15*	188

Note. *Bonferoni Correction Adjustment $p < 0.00278$

Research Question 4: Do middle school science teachers in China and the United States differ in their levels of autonomy support? The U.S. and Chinese teachers differed significantly for the factors of high autonomy support and moderate autonomy support (Table 22). The U.S. teachers had a significantly higher mean for high autonomy support while the Chinese teachers had a significantly higher mean for moderate autonomy support. The teachers did not differ in their means for the controlling factor.

The scale composite for *The Problems in Schools Questionnaire* was calculated using Equation 4. The three factors represent a spectrum of autonomy support, and a higher composite score corresponds to increased autonomy support for students. The U.S. and

Chinese teachers did not have significant differences in their scale composite means indicating that the two groups of teachers reported similar levels of autonomy support for students.

Table 22

Levels of Autonomy Support by Middle School Science Teachers in China and the U.S. by Factors and Scale Composite

Factor	U.S.	China	<i>t</i>	df
	Mean (SD) (n = 94)	Mean (SD) (n = 107)		
High autonomy support	5.82 (0.64)	4.83 (1.15)	7.69*	171
Controlling	3.39 (0.90)	3.21 (1.25)	1.21	192
Moderate autonomy support	3.63 (0.89)	4.76 (1.23)	-7.54*	193
Scale composite	5.46 (0.67)	5.23 (1.45)	1.45	154

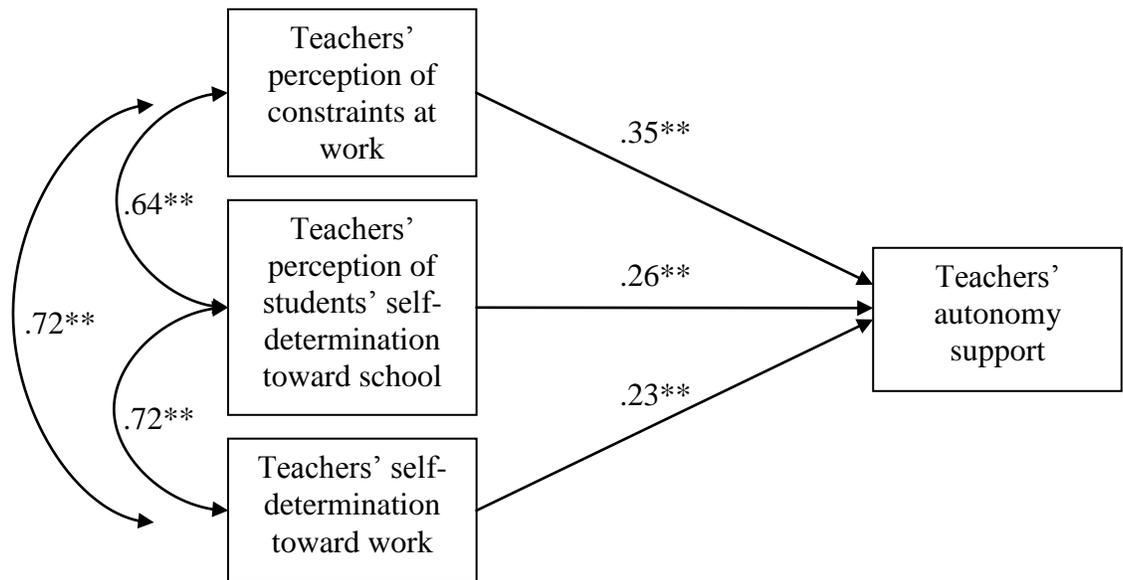
Note. *Bonferoni Correction Adjustment $p < 0.00278$

Multiple Regression

Research Question 5: Does the structural model of indicator variables developed by Pelletier et al. (2002) predict middle school science teachers' levels of autonomy support in China and the United States? Multiple regression using the scale composites was used to model the relationships between the four constructs of teachers' perceptions of constraints at work (constraints at work), teachers' perceptions of students' self-determination toward school (students' self-determination), teachers' self-determination toward work (teachers' self-determination), and teachers' autonomy support (autonomy support) for the U.S. and

Chinese samples. The models were developed through a series of steps that tested different combinations of predictor and outcome variables.

Step 1. In the initial tests, constraints at work, students' self-determination, and teachers' self-determination were used to predict the outcome variable of autonomy support. The results for the Chinese sample are shown in Figure 3. Each of the predictor variables made a significant contribution to the prediction of teacher autonomy support; therefore, Figure 3 is the final model of the relationships between the four constructs for the Chinese sample.



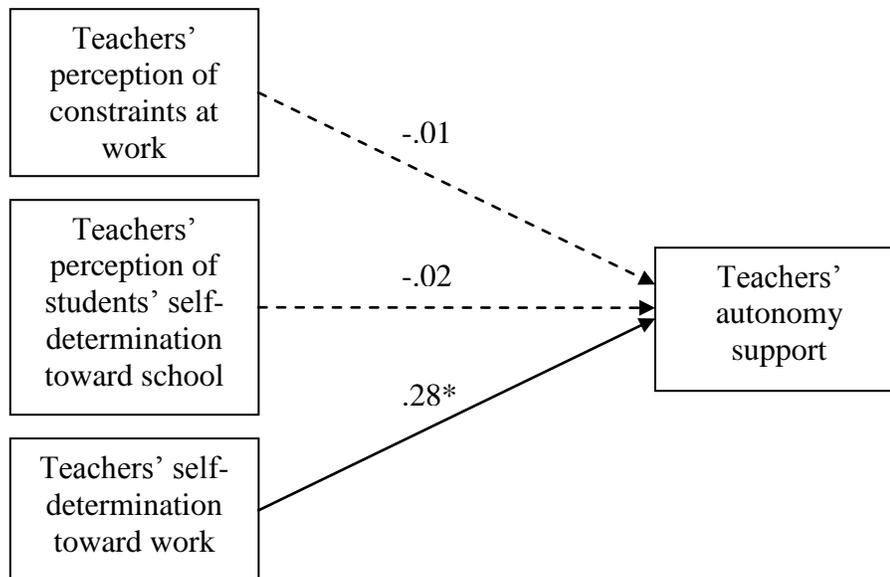
Note. **p < .01

Figure 3. Final Multiple Regression Model for Chinese Teachers

The relationships are positive indicating that higher scale composite scores for the predictor variables correspond to a higher level of autonomy support. As noted previously, higher scale composite scores for teachers' self-determination and students' self-

determination also correspond to a higher level of self-determination, intrinsic motivation, and perceived autonomy. The predictor variables are all significantly correlated with one another as shown by the arrows on the left side of the figure.

The results of the same test for the U.S. sample are shown in Figure 4. For the U.S. sample, only teachers' self-determination was a significant predictor of autonomy support. The constructs of constraints at work and students' self-determination were not significant predictors of autonomy support as indicated by the dashed lines.



Note. * $p < .05$

Figure 4. Initial Multiple Regression Model for U.S. Teachers

Next, analyses were done to determine if teachers' self-determination was mediating the effects of constraints at work and students' self-determination on the outcome variable of autonomy support for the U.S. teachers. The results of the tests are summarized in Figure 5.

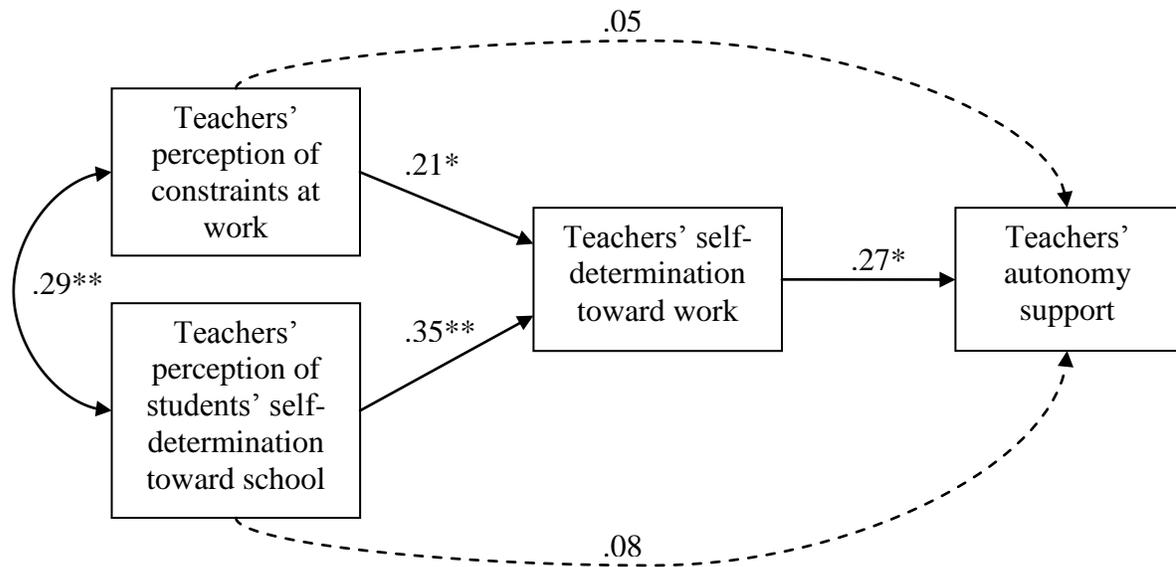
Step 2. Constraints at work and students' self-determination were found to be significant predictors of teachers' self-determination. Both relationships are positive indicating that higher scale composites for constraints at work and teachers' self-determination correspond to higher levels of teachers' self-determination.

Step 3. Constraints at work and students' self-determination were *not* found to be significant predictors of autonomy support when teachers' self-determination was not included in the regression analysis. For mediation to occur, constraints at work and students' self-determination would have to significantly predict autonomy support without teachers' self-determination included. Consequently, teachers' self-determination does not mediate the effects of constraints at work or students' self-determination on the outcome variable of autonomy support.

Step 4. Teachers' self-determination was found to significantly predict autonomy support when the constructs of constraints at work and students' self-determination were not included in the regression. Again, the relationship is positive indicating that higher levels of teachers' self-determination correspond to higher levels of autonomy support. The predictor variables are significantly correlated with one another; the correlation between constraints at work and students' self-determination is represented by the arrow on the left side of the figure.

In summary, for the U.S. sample constraints at work and students' self-determination do not significantly predict autonomy support, but they do significantly predict teachers' self-determination. Teachers' self-determination significantly predicts autonomy support, but it

does not mediate the effects of constraints at work or students' self-determination on autonomy support.



Note. * $p < .05$; ** $p < .01$

Figure 5. Final Multiple Regression Model for U.S. Teachers

Correlations of scale composites. Tables 23 and 24 show the correlations among the scale composites for the Chinese and U.S. teachers, respectively. For the Chinese teachers, all of the correlations are significant and four of the r values are greater than .70. These are acceptable levels of correlation. If the r values were greater than .90, multicollinearity, extreme correlation among the variables, would be a concern (Garson, 2010). Four of the six correlations are significant for the U.S. teachers.

Table 23

Correlations of Scale Composites for Chinese Teachers (n = 107)

Scale Composite	1	2	3	4
1. Constraints at Work	----	.64**	.72**	.76**
2. Perceptions' of Students' Motivation		----	.72**	.70**
3. Work Motivation			----	.76**
4. Problems in Schools				----

Note. **Correlation is significant at the .01 level (2-tailed).

Table 24

Correlations of Scale Composites for U.S. Teachers (n = 94)

Scale Composite	1	2	3	4
1. Constraints at Work	----	.29**	.31**	.07
2. Perceptions' of Students' Motivation		----	.42**	.09
3. Work Motivation			----	.27**
4. Problems in Schools				----

Note. **Correlation is significant at the .01 level (2-tailed).

Summary

The results of the EFA of the four survey assessments resulted in new or different factor structures than the original instruments. The factor structures based on the study sample for the *Work Motivation Inventory*, *Perceptions of Students' Motivation*, and *The Problems in Schools Questionnaire* were simpler than the original factor structures, but they still related to the theoretical framework of the instruments and the constructs of interest in

this study. The factor structure for *Constraints at Work* was different from the original factor structure because it contained all of the items. Significance testing indicated differences in U.S. and Chinese teachers' perceptions of constraints at work and teachers' self-determination toward work. The two groups of teachers did not differ significantly in their perceptions of students' self-determination toward school or their reported levels of autonomy support. When the constructs of constraints at work, students' self-determination, and teachers' self-determination were used to predict the outcome of autonomy support, differences emerged in the relationships among the four constructs for Chinese and U.S. teachers. For the Chinese teachers, all three variables were significant predictors of autonomy support, but for the U.S. teachers only teachers' self-determination was a significant predictor of autonomy support.

CHAPTER FIVE: RESULTS OF THE OPEN-ENDED INTERVIEW QUESTIONS

A summary of the middle school science teachers' responses to the open-ended interview questions (Appendices E, F, and G) is provided below. The questions were designed to address Research Question 6: *Are there differences in middle school science teachers' reported instructional practices in China and the United States?* The summary is based on the responses of ten middle school science teachers in the U.S. and nine middle school science teachers in China. The U.S. teachers were interviewed over the phone or in person, and the Chinese teachers wrote their responses to the questions due to limited internet access. The summary is organized around four main themes: instructional practices, constraints at work, teacher autonomy and motivation, and student autonomy and motivation.

Instructional Practices

Planning and instruction. The U.S. teachers described using a variety of instructional practices with their students including lecture, discussion, labs and inquiry investigations, and small group and individual work. Leslie stated that she used "a variety of different activities" in order to "reach the needs of [her] students." She felt that her autonomy to change the way she presented material was crucial to motivating students. Janet described teaching a unit on measurement that she begins with an inquiry activity in which students measure the school auditorium using nonstandard units. At the center of the U.S. teachers' choices of instructional practices was consideration of their students' abilities, needs, and interests. Teachers described using multiple methods of instruction to engage and motivate students with different interests.

The Chinese teachers described using laboratory investigations and lecture during their classes. Yong described using experiments to cover physics topics with his middle school students. For Yong, lab investigations were crucial to the learning process in order to “help students learn why it is instead of what it is.” Similarly, Yen expressed the desire for her students to be able to “get close to nature” when they learned about biology and the biosphere. Like the U.S. teachers, eight of the Chinese teachers felt that using different types of teaching methods were important to motivating their students and improving student learning.

The U.S. and Chinese teachers both described modifying their instructional practices at the end of a unit or semester. In Tara’s case, she asked students for their suggestions of better ways to teach topics and then used the student feedback to develop new lessons. She said the process was motivating for the students because, “they get to see their own classmates being successful with something that they came up with.” Fang and Chen described a reflective method of refining their teaching by finding and correcting mistakes in their delivery of material. Other Chinese teachers mentioned modifying their instruction in more subtle ways such as the quantity of homework, allowing students to ask questions in class when they do not understand the content, class discussions, and allowing students to choose how they finish class activities. Teachers in both countries mentioned changing the pace of their instruction based on student feedback. For Chinese and U.S. teachers, control over the pace of content coverage was constrained by curriculum and standards.

Assessment. The U.S. teachers described using several methods to assess student learning including formative and summative assessments. Again, teachers often varied the

types of assessments based on their students' instructional needs. Cody described using differentiated assignments with rubrics and allowing students to choose which assignment they wanted to complete. Tara and Greg had students create portfolios of their class work and reflections at the end of a chapter or unit. In the words of Tara, "I would rather assess them by things they are doing in the classroom...I am a terrible test taker. I try not to forget being a student myself."

The Chinese teachers did not describe specific classroom assessments; however, three of the teachers mentioned standardized assessments that influenced their teaching. These teachers discussed the importance of college entrance exams on their planning and instruction. Jin said that his autonomy was limited by the college entrance exam, because he had to "teach the knowledge in the textbooks." Yong mentioned the influence of the college entrance exams throughout his interview referring to it as, "the examination problem, which shapes our teaching, planning, and evaluation." Only Chen felt that he had the most autonomy over evaluations that he designed and used in the classroom. He stated, "Planning and instruction are limited by the master syllabus. Comparatively speaking, evaluation is better because I can give my own opinion."

All of the U.S. teachers mentioned standardized assessments implemented at the state or district levels. Five of the teachers used this data in collaboration with other teachers in their schools or districts to modify their instructional practices. In Rene's district, school performance on state tests were shared at the beginning of each year "for everyone to see what schools did well, what schools did not." The teachers in her district gathered twice during the school year to create benchmark tests for their standards. Four of the teachers

described working collaboratively in professional learning communities (PLCs) within their schools to create common assessments. These teachers had positive comments about the process and felt it was beneficial to students. In Greg's case, he appreciated being able to use a mixture of uniform assessments, in order to compare data, and classroom assessments of his choice.

Collaboration with colleagues. Collaboration among teachers was a recurring theme mentioned by eight of the U.S. participants. Seven of the teachers felt that collaboration with colleagues was positive. In Leslie's school, PLCs met together once a week to plan their lessons and the activities that will be used in class. Greg and Tara described using email and network drives to share lessons and assessments. Beth and Susie, who taught at smaller schools, were the only science teachers at their grade level. They expressed disappointment in not having peers in their school buildings with whom they could collaborate. Despite the fact that teachers lost some degree of individual autonomy through shared decision-making, they felt that collaboration had a positive impact on teaching. Only one teacher, Rene, felt like the amount of collaboration was becoming too restrictive. She stated, "And now we're being told that we have to decide on certain labs for school in that district. We have to do the same thing. It's almost like, anymore, we can't do our own thing."

The Chinese teachers did not describe the extent to which they worked collaboratively with other teachers or individually to plan and make student assessments. Two of the questions asked the teachers to indicate if they had to consider their colleagues when planning science lessons and labs. Three of the Chinese teachers reported that they had

to consider colleagues when planning lessons and four of the teachers reported considering colleagues when planning to teach science labs.

Constraints at Work

Funding for materials, equipment, and lab space. In the interview, participants were asked about factors that constrained their teaching and reduced their autonomy regarding decisions about teaching science. The U.S. teachers cited money as the primary factor that restricted their decisions regarding aspects of their teaching. Throughout all 10 of the interviews, money was mentioned directly, in terms of small and shrinking budgets, and indirectly, in terms of limited resources, lab materials, and large class sizes resulting from too few teaching positions. In the words of Rene, “Money is a big problem. That’s something we have to be careful with and we don’t have as much anymore. And that’s always a constraint.” For the Chinese teachers, money was not as prevalent in their responses. Only five of the Chinese teachers described constraints from funding for materials, equipment, or lab space.

When asked to describe their ideal teaching situations, eight of the U.S. teachers quickly responded with lists of materials they would like to have for their students. Most lists included an increase in the number of student computers and more lab supplies. For example, Beth stated, “I would like to have more technology. Every student would have a laptop.” Leslie, who taught 165 sixth grade students, described the difficulty of purchasing and storing materials in her room for a large number of students. In response to the same question, only half of the Chinese teachers mentioned improvements in materials and classrooms. Shen and Jin expressed a desire for “beautiful” teaching environments while Chen hoped for “advanced equipment.” Rather than focusing on material resources, the

Chinese teachers wanted improvements in the relationships and interactions between teachers and students in their ideal teaching situations.

Six of the U.S. teachers described working in classrooms with desks instead of tables and no access to lab space. Susie described her classroom by stating, “There are some labs that we just can’t do, because we don’t have the resources for them...I have to be able to set up the space and figure out how to do it in a classroom that’s not really made for science.” Similarly, the U.S. teachers reported limited storage for materials and equipment. In Tim’s case, constraints on building and classroom space meant that the science lab had become a classroom. In order to take his students to lab, he said he had to make arrangements with another teacher and swap rooms for the day. The limited access to materials, equipment, and space as described by eight of the U.S. teachers affected their decisions regarding planning, instruction, and assessment.

School curriculum and standards. After constraints related to money and materials, the next most common constraint mentioned by all of the U.S. teachers was the school curriculum and teaching standards. The impact of the standards was apparent in numerous comments throughout the interviews. Susie summed up the importance of the state curriculum by stating, “It’s the Bible.” The Chinese teachers also mentioned constraints from the “master syllabus.” Yen expressed her frustration that lab investigations were not completed for authentic learning experiences but in order to complete a set of tasks on the master syllabus. Five of the Chinese teachers described how the master syllabus was the primary constraint on their teaching. In the words of Min, “The master syllabus decides everything.”

Though the autonomy of the teachers was constrained by school curriculum and standards, teachers often prefaced their comments with phrases like, “I understand the reason for standards.” Tim expressed his appreciation for the standards as guidelines that helped him stay on track. Similarly, Greg was comfortable with the organization of lessons around the same state standards and essential questions and then individualizing the delivery of instruction for his students. Yen did not want complete autonomy over her teaching, because she felt that it was important to “achieve the teaching goals first.”

Rather than being frustrated with the existence of state and national standards, teachers in both countries felt constrained by the amount of material they were expected to cover in one school year. Ping stated, “There is too much to teach and not enough time.” In the words of Beth, “How did they expect us to cover all of this material?” Tara described the amount of material in the standards as “impossible” and stated, “I just feel like I’m skimming the top of everything...it’s a little disheartening.” Teachers in both countries felt pressure to cover large amounts of material in a short amount of time and expressed concern that they could not slow down to allow students to explore topics or to re-teach material. Only one of the U.S. teachers, Angela, said that she had to follow a pacing guide for her teaching.

Class size. Six of the U.S. teachers described frustration with large class sizes that were a result of limited classroom space and funding for additional teaching positions. U.S. teachers mentioned class sizes as large as 35. At the schools of some of the U.S. teachers, students with learning disabilities were in special classes for math and language arts and mainstreamed for science and social studies. The broad range of learning abilities intensified

the struggle to reach each student. In the words of Rene, “When I have a big class and I have to cater to every different kid in there...it is hard to know how to reach them.”

Some of the teachers, like Tara, wished for drastic reductions in class size in order to have as few as eight students. Other teachers wished for reductions that were more modest to classes of 20 students. In sharp contrast to the U.S. teachers, the Chinese teachers reported ideal class sizes ranging from 30 to 50 students. Leslie, a U.S. teacher who worked with 165 sixth graders, did not feel like she knew her students and their abilities until halfway through the school year. Faced with the demands of individualizing instruction for large numbers of students, the U.S. teachers expressed their determination to do their best. As Tara said, “You’ve just got to adapt and do your job regardless...I know I won’t get to all of them, but I will try.” Tim echoed this resolve when he stated, “It’s a challenge, but it’s something I’ve accepted.”

Relationships with administrators. Five of the U.S. teachers described their relationships with administrators as positive. These teachers portrayed their administrators as trusting and supportive of their teaching. Tara and Greg explained that their administrators were instrumental in creating a supportive community at the school. Other teachers, like Tim and Cody, described a more distant relationship with administrators; they had autonomy over their teaching and lesson planning as long as they covered the expected material. In Leslie’s case, her administrator expected “high level, rigorous lessons,” but she was free to select the learning activities for her students. One of the teachers, Rene, felt that her teaching was constrained by a lack of trust from school and district administrators. She found this lack of trust frustrating and upsetting. She stated, “In leadership you have to establish a good

rapport, and then your team will do well. You have to trust them... And when you feel trusted, you tend to do better.”

The Chinese teachers did not explicitly describe their relationships with administrators; however, they made indirect statements in regards to constraints on their teaching. Three teachers reported that they had to consider constraints related to administrators when planning science lessons, and six teachers reported that they had to consider administrative constraints when planning science labs. Beyond the school level, one teacher, Shen, stated that his teaching was constrained by government strategies, while Yen said her teaching was constrained by “educational models and teaching conditions.”

Teacher Autonomy and Motivation

Satisfaction with current levels of autonomy. When asked if they were satisfied with the amount of autonomy they had over their teaching, all of the U.S. teachers responded positively. Susie’s response of, “Yes, because I have a lot,” was typical of the teachers. Rene was satisfied with her current level of autonomy but described concern that it might diminish. She stated, “Right this minute I guess I could say ‘yes’, but it could change very quickly. I’m worried that with a different administration we are going to have less of that pretty soon.” In sharp contrast to the U.S. teachers, only two of the Chinese teachers were satisfied with their levels of autonomy. The other seven teachers wanted more autonomy. For example, Jin stated, “I am limited in many aspects with my low autonomy. I cannot teach in the special way that I want to.”

Importance of teacher autonomy. Nine of the U.S. teachers felt autonomy was important, because they needed to be able to individualize instruction to meet the needs of

their students. They wanted to be able to select activities and pace instruction based on the characteristics of their students. Tim stated, “How effective can we be if we’re teaching in only one way to everyone? With American education we want to try and educate everyone the same way, and that just doesn’t really work.” Eight of the Chinese teachers also felt that autonomy was important for individualizing instruction. They gave examples of altering the pace of instruction, the amount of homework, and the organization of content based on the needs of their students. Min said that she tried to teach as “freely” as possible and change her teaching methods “according to the extent to which the students master the knowledge.” Yong felt that with autonomy teachers would be able to improve student learning “without hindering the pace of instruction.”

Influence of autonomy on motivation. Seven of the U.S. teachers felt that autonomy was essential to teacher motivation. Beth stated, “I love [autonomy] because I can be creative. I can do what my instinct tells me the children need.” Tim said, “I think [autonomy] is absolutely essential. We couldn’t have science teachers without it.” Similarly, six of the Chinese teachers felt that autonomy was important to teacher motivation and quality of instruction. These teachers mentioned the importance of autonomy to motivate teachers to refine their teaching practices and better meet the needs of their students. Like Beth’s quote, three of the Chinese teachers said their motivation for teaching came from their students’ eagerness to learn and their students’ futures. One teacher, Shen, said that he was motivated by his good relationships with colleagues and the families of his students.

Three of the U.S. teachers were more cautious about the role of autonomy in teacher motivation alluding to different motivators for different kinds of teachers. In the words of

Janet, “Some teachers are really hard to motivate.” Janet and Tim were personally motivated by autonomy but felt that other teachers might be more motivated by money or job security. Greg felt that teacher autonomy was important to motivating students stating, “Students tend to pick up on that lack of enthusiasm and that lack of individualized creativity...Everyday you teach in front of students, you’re putting on a show. And they’re able to pick up on if it’s a re-run or if it’s a newly televised program.” Yong expressed a very discouraging view of the importance of motivating teachers to do their best. He stated, “Because of the lack of autonomy, stimulating teachers to do their best becomes unimportant.”

Student Autonomy and Motivation

Similar to their beliefs that teacher autonomy was important to teacher motivation, the Chinese and U.S. teachers felt that student autonomy could help improve student motivation and learning. The teachers in both countries said that their students rarely, if ever, were able to choose the topics about which they would learn; however, the teachers tried to build in choice through other aspects of instruction. Seven of the U.S. teachers described offering the students a variety of options for projects and learning activities including inquiry investigations. Leslie stated, “I notice kids that are not overly motivated in school tend to be more motivated during inquiry labs.” Tim felt that allowing students choices was motivating for students and helped them to “go to a deeper level” of learning.

Six of the Chinese teachers described offering students choices in a more limited way. They described student choices related to asking questions in class, selecting how to finish classroom activities, the amount of homework, and the pace of instruction. Yong’s response was particularly important for science instruction; he thought student autonomy was “very

important [because] it allows students to experience the inquiry process.” Five of the Chinese teachers wanted a classroom environment that was relaxed with high participation from the students. Yong and Shen wanted students to have open minds and opportunities. Yong wanted his students to have opportunities like he saw “in American movies [where] students have more autonomy and they can take the courses they wish.”

Summary

Overall, the U.S. teachers reported a greater diversity of instructional and assessment practices than the Chinese teachers. Both groups of teachers reported that they modified their instruction based on the needs of their students and felt that this individualization of instruction was one of the most important reasons that teachers should have autonomy over their teaching. Teachers in both countries reported that standardized assessments heavily influenced their teaching. Only the U.S. teachers described collaborating with their colleagues to plan instruction and assess student learning.

In their ideal teaching situations, U.S. teachers wished for more material resources and smaller class sizes; the Chinese teachers wanted learning environments that encouraged student participation and improved their relationships with students. The primary constraint reported by U.S. teachers was limited funding for materials, equipment, and lab space; while the primary constraint reported by the Chinese teachers was school curriculum and standards. For teachers in both countries, their greatest frustration with school curriculum and standards stemmed from the large amount of material they were expected to cover during the school year. Class size was a constraint mentioned by the U.S. teachers, but not by the Chinese teachers. Although from the responses of the Chinese teachers, it seems that they had larger

class sizes than the U.S. teachers. The U.S. teachers were divided on their relationships with administrators with only half of the teachers reporting positive relationships. The Chinese teachers did not directly describe their relationships with administrators, but about half of the teachers did report considering constraints from administrators when planning lessons and science labs.

Teachers in both countries overwhelmingly agreed that teacher autonomy was important to motivating teachers and improving the quality of instruction. The U.S. teachers were unanimously satisfied with their current levels of autonomy while only two of the Chinese teachers were satisfied with their autonomy. Teachers in both countries felt that student autonomy was important to motivating students and enriching their learning. While school curriculum and standards dictated the topics of instruction in both countries, the U.S. and Chinese teachers tried to build in choices for their students in regards to other aspects of learning such as the type of activity or pace of instruction.

Limitations of the Study

There were four primary limitations to the current study. First, the study relied on the translation of several survey assessments. As noted previously, translations can affect the psychometric properties of survey instruments due to differences in language structure and cultural references (Fossati, et al., 2001; Kitamura, et al., 2004; Ryan, et al., 1999). More information is needed to determine the extent to which translation affected the results of the statistical analyses of the survey data. Second, the Chinese and U.S. participants of the study sample were more educated than the national averages. In the Chinese sample, this difference was much more pronounced than for the U.S. sample. Due to the differences between the

study samples and national averages, it cannot be assumed that the results of this study would apply to all Chinese and U.S. middle school science teachers. Third, all participants were volunteers and the data were self-reports. Data collected through observations would have been helpful to assess the reliability and validity of the teachers' responses; however, observations would have prevented anonymous participation by the teachers. Finally, the Chinese participants in the second part of the study wrote their responses to the open-ended interview questions. The written responses were shorter than the oral responses of the U.S. participants. While the additional probes for Chinese participants helped yield comparable results, in the future, it would be beneficial to collect data from Chinese middle school science teachers through interviews as originally planned. The interviews would provide a richer insight into the factors that affect the instructional practices, autonomy, and motivation of middle school science teachers in China.

CHAPTER SIX: DISCUSSION

This study examined factors that contribute to Chinese and United States middle school science teachers' perceptions of autonomy support. The study used a mixed methods design including quantitative data collected through an online survey and qualitative data collected through open-ended interview questions. The quantitative data was used to test the structural model developed by Pelletier et al. (2002) while the qualitative data was used to collect information specific to science instruction as well as issues related to autonomy and motivation for middle school science teachers.

Study Results in the Context of Previous Research

Results of the exploratory factor analysis of survey data for the present study yielded different factor structures for each of the four survey assessments than those used in the original study by Pelletier et al. (2002). As a result, comparisons between models from this study and the original study are limited to basic comparisons of overall structure. Figure 6 shows the original model and the models for U.S. and Chinese teachers developed in this study. The Pelletier et al. model shows teachers' self-determination mediating the effects of constraints at work and students' self-determination on autonomy support. The U.S. model is very similar with one important difference. For the U.S. teachers, teachers' self-determination did not mediate the effects of constraints at work and students' self-determination. These constructs were not significant predictors of autonomy support when teachers' self-determination was removed. For the Chinese teachers, all three constructs were found to be significant predictors of autonomy support. The original study sample consisted

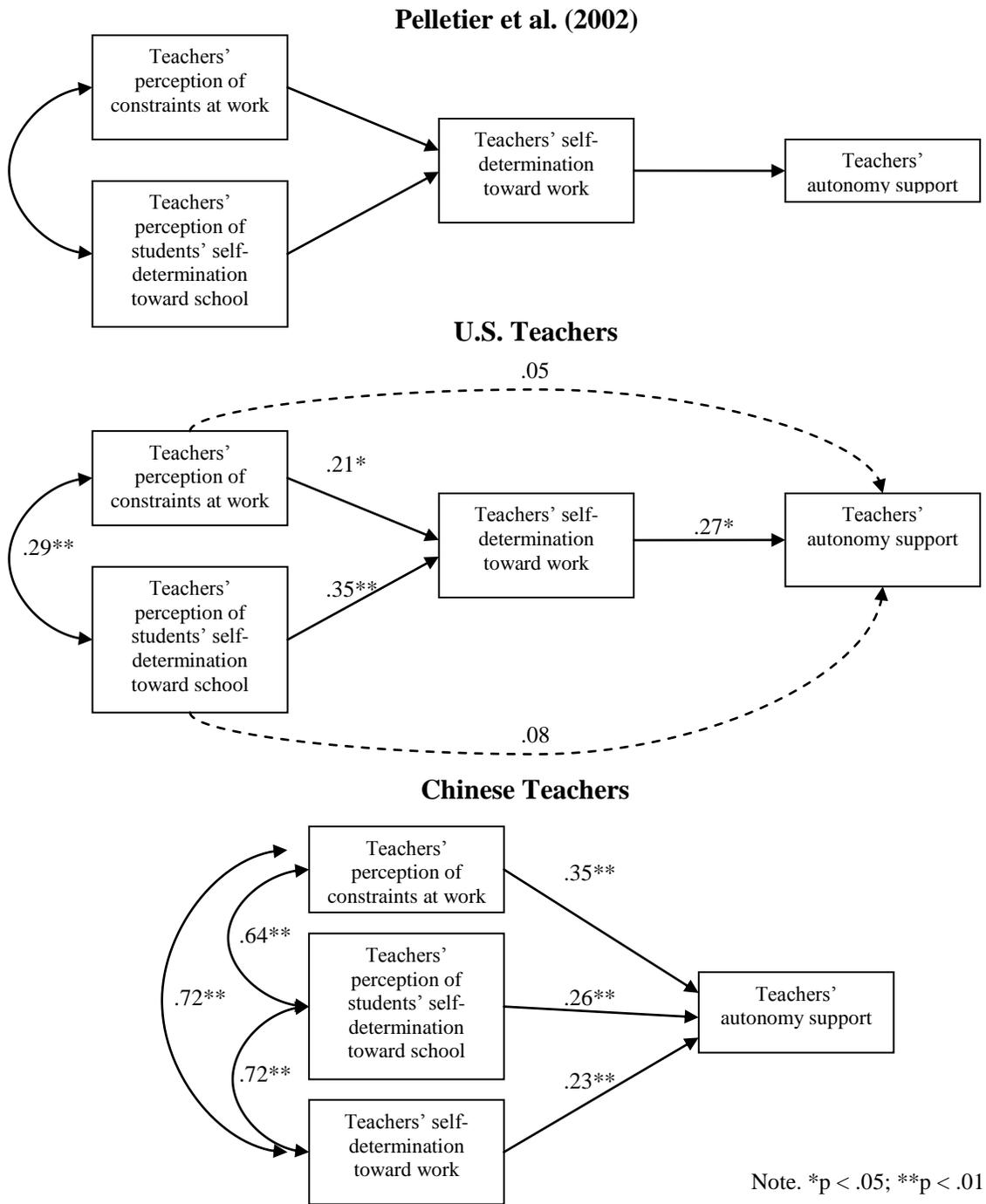


Figure 6. Structural Model Developed by Pelletier et al. (2002) and Final Multiple Regression Models for U.S. and Chinese Teachers

of 254 French-Canadian teachers. Based on the results of this study, U.S. teachers and French-Canadian teachers have more similarity in their motivation toward work and perceptions of their work environment than Chinese teachers.

Comparisons of the U.S. and Chinese models reveal differences in the number of factors that predict teachers' self-determination and teachers' autonomy support. In self-determination theory (SDT), Deci and Ryan (Deci & Ryan, 1985, 2000; Ryan & Deci, 2000) describe three needs important for well-being: autonomy, competence, and relatedness. The extent to which these needs are met determine how self-determined individuals feel and their motivation to engage in tasks. Teachers' self-determination is a very individualistic characteristic as opposed to constraints at work and students' self-determination in which teachers consider the broader community of students, colleagues, administrators, and parents. Of the constructs examined in this study, U.S. teachers' self-determination toward work was the only significant predictor of the amount of autonomy support they provide students.

The importance of an individualistic characteristic relative to other factors based on the broader community of the school is consistent with research on individualism and collectivism (Hofstede, 2001; Triandis, et al., 1988) as well as independent and interdependent self-construal (Markus & Kitayama, 1991). Members of individualist cultures, like the United States, tend to place greater emphasis on their own goals than the goals of the group (Iyengar & DeVoe, 2003; Triandis, et al., 1988). For the Chinese teachers, their self-determination toward work, perceptions of the work environment, and students' motivation were all significant predictors of their autonomy support. This is again consistent with the tendency of members of collectivist cultures to place a higher emphasis on

relationships with other members of the group than individual goals (Iyengar & DeVoe, 2003; Triandis, et al., 1988).

The Chinese teachers were less intrinsically motivated toward their work than U.S. teachers as measured by *The Work Motivation Inventory*. Previous research on the relationship between autonomy and motivation with people from Asian countries has found that more autonomy does not always result in greater motivation (Bao & Lam, 2008; Iyengar & Lepper, 1999). These studies have found that the relationships between the individual and the larger group may have an impact on motivation and the extent to which the individual feels autonomous in certain situations. Data from the interviews corroborates the survey findings. All of the U.S. teachers in the interview were satisfied with their current levels of autonomy citing their independence to select laboratory activities, design assessments, and individualize instruction for their students. Conversely, only two of the Chinese teachers were satisfied with their current level of autonomy. They described feeling more limited in their control over decisions regarding how they taught science. The lower levels of work motivation and discontent with levels of autonomy are consistent with SDT and the self-determination continuum (Ryan & Deci, 2000). Furthermore, the Chinese teachers described constraints on their teaching due to college entrance exams. Previous studies in China, have documented the strong influence of secondary school examinations on science teaching at the middle school level, and efforts are being made to increase the instructional time spent on application (Wei, 2009).

The complexity of the relationships between relatedness, autonomy, and motivation has been revisited multiple times (Deci & Ryan, 2000; Katz & Assor, 2007) and is still under

study. A recent study compared individuals from the U.S., Russia, and China and the extent to which autonomy support from partners affected self-concept and feelings of well-being (Lynch, La Guardia, & Ryan, 2009). The results of the study revealed that while some differences existed in the strength of the effect of autonomy support for participants from the three countries, in general, autonomy support had a positive impact on self-concept and well-being regardless of country or culture (Lynch, La Guardia, & Ryan, 2009). The results of the interview portion of the current study also support the importance of autonomy to members of collectivist cultures. The Chinese teachers all agreed that teacher autonomy was important to teacher motivation and the quality of instruction provided by teachers. Teacher autonomy was deemed especially important for the selection and implementation of lab investigations to deepen student understanding of science content.

The results of the quantitative and qualitative data analyses indicated that middle school science teachers in the U.S. and China had differences in their perceptions of constraints at work. The U.S. teachers felt most constrained by funding issues related to materials, equipment, lab space, and class size while the Chinese teachers felt more constrained by expectations related to the school curriculum and standardized testing. The U.S. teachers focused on material items when describing their ideal teaching situations while the Chinese teachers focused on their relationships with students and the classroom environment. These differences may reflect individualist versus collectivist goals, but they may also reflect extreme differences in teaching environments. Additional research is needed to explore differences that may exist in classroom environments.

Previous studies have found that teachers that have more autonomy and are more self-determined in their work are more likely to support the autonomy of their students (Deci, et al., 1982; Pelletier, et al., 2002; Sheldon & Biddle, 1998). For both the U.S. and the Chinese teachers, there was a positive relationship between teachers' self-determination toward work and the level of autonomy they reported providing to students. Furthermore, the U.S. teachers who were more self-determined toward their work and felt more autonomous, also reported more methods of individualizing their instruction to meet the needs of their students. This is consistent with previous work by Gess-Newsom and Lederman (1995) who found that science teachers that felt more autonomous in their work were more aware of students in their planning and teaching. Although teachers in both countries reported constraints related to school curriculum and standards, the U.S. teachers reported feeling more autonomous in their choices about how to teach the predetermined science content standards.

Teachers in both countries felt that providing students opportunities to be autonomous in their learning was important to student motivation and learning. Previous research has found that students are positively influenced by autonomy support by their teachers (Chirkov & Ryan, 2001; Deci, Schwartz, et al., 1981). The teachers in both countries reported that students were rarely able to select the topic of study due to the school curriculum and standards; however, the teachers did report trying to build in choices regarding other aspects of learning such as the type of lab activity or pace of instruction. The choices described by the Chinese teachers, such as allowing students to ask questions or participation in class discussions, were more subtle than those described by the U.S. teachers. Cordova and Lepper (1996) found that students responded positively to choices even when choices did not affect

the content of the activity. The attempts of the U.S. and Chinese teachers to provide similar types of choices for their students, while still adhering to the school curriculum and standards, are likely to have similar positive results.

Implications

Consider a typical middle school science teacher working at a public school in the United States. Perhaps, she has a placement teaching seventh grade students. Upon entering the classroom, a substantial portion of her work has been predetermined for her. State and national standards determine the science content that she will cover. Curricular materials, most likely in the form of textbooks, were selected by the school district. She works in the classroom assigned to her and shares lab space with other science teachers. She and the other seventh grade science teachers are expected to meet weekly to plan instruction and create common assessments in the form of unit tests. Her students are evaluated by standardized tests implemented at the district and state levels. Her effectiveness as a teacher is evaluated based upon her students' performance on these tests. How much autonomy does she truly have over her teaching? How motivated will she be in this environment? How much creativity and enthusiasm will she bring to her interactions with students?

The interviews with Chinese and U.S. teachers in this study revealed that teachers really want choice, and they want choice about many aspects of their teaching. The teachers expressed their desires to determine classroom organization, planning, instruction, assessment, use of laboratory activities, and pacing of instruction. This autonomy was important to the teachers' motivation, and they believed it was critically important to their abilities to meet the needs of their students. Even though China and the United States have very different cultures and educational traditions, the teachers in both countries clearly articulated a complex dynamic between autonomy and constraint.

Many of the constraints came from political and administrative places that the teachers cannot control. When these constraints affect very specific things in the classroom, the teachers in both countries expressed frustration. Some of the constraints seemed more fixable, like supplies and materials, but other constraints from government strategies such as state standards and standardized assessments seem much less movable. For classroom teachers, there exists a tenuous balance of many different levels of constraints and choices influencing their daily instruction. Sometimes teachers appreciate having guidelines, but at other times, the guidelines feel too restrictive. Perhaps how a teacher perceives constraints differs by experience level or confidence. Differences may also be context specific. As an affluent country, how much does wealth influence U.S. teachers' perceptions of constraints related to material resources? This study did not examine Chinese classrooms and their resources, but the teachers reported less constraint from material resources.

Over the past 25 years, the amount of control over classroom instruction held by local, state, and national governments has increased dramatically. At the same time that teachers are losing control over classroom instruction, there is an increasing emphasis around the world on holding teachers accountable for student learning as measured through standardized assessments (Bushnell, 2003; Delandshere & Petrosky, 2004; McDonald, 2002; Mustafa & Cullingford, 2008; van Veen et al., 2001; Yeom & Ginsburg, 2007). International studies like the *Trends in International Mathematics and Science Study* and the *Program for International Student Assessment* have become a regular part of evaluating student learning. However, little consideration is given to the people who teach these students or the environments in which they work. In the U.S., large numbers of teachers are leaving the

profession; these teachers cite lack of autonomy and support from administrators as primary reasons for their dissatisfaction (Ingersoll, 2001). Unfortunately, consideration of teacher autonomy is limited or absent from educational reform in the U.S. In a review of nine U.S. reform documents spanning almost three decades, teacher autonomy was not mentioned once (Yeom & Ginsburg, 2007). Looking across the results of this study and previous research, it is apparent that teacher autonomy is too important to the future of education not to consider in educational decisions.

Teachers need opportunities to feel autonomous in their work. The Chinese and U.S. teachers in this study did not want complete autonomy; rather, they wanted the ability to adapt their teaching to the needs of their students. Teachers accept the constraints of the school curriculum and standards as guidelines for their teaching. However, teachers reported feeling frustrated by pressure to move on to the next topic in order to cover all of the content standards, regardless of whether students have mastered the material.

Providing teachers with autonomy has beneficial impacts on teacher motivation and instruction. The teachers in this study were highly motivated by freedom in planning, instruction, and assessment. They reported using a wide variety of instructional methods when given autonomy over these tasks. Teacher autonomy can also have beneficial impacts on student motivation and learning. The teachers in this study reported that their students were more motivated and engaged when they had autonomy over their learning. For example, Leslie stated, “If [students] feel like they are being told what to do all the time, I don’t think they’re going to like it. And I notice when we do inquiry labs, kids that are not

usually overly motivated in school tend to be more motivated.” Providing teachers with opportunities to feel autonomous can directly benefit teachers and students.

U.S. teachers value opportunities to collaborate. The U.S. teachers in this study related positive experiences of collaborating with other science teachers. These findings are promising given the recent surge in collaborative movements like professional learning communities. Teachers may appreciate this type of shared decision-making and reflective practice even though it reduces the autonomy of the individual teacher. This is evidence once again that teachers do not seek complete autonomy over their teaching; they appreciate input from others. Efforts to increase collaboration should be balanced by individual autonomy on the part of the classroom teacher to adapt instruction to the needs of students.

Middle school science teachers in the U.S. may need more materials, equipment, and lab space. The greatest constraint on the U.S. teachers in this study was limited access to materials, equipment, and lab space. The increase in emphasis on inquiry and hands-on science by the *National Science Education Standards* (NSES) (National Research Council, 1996, 2000) means that many teachers may perceive the need for more materials and lab space. Some of the teacher in this study reported they were working in traditional classrooms with desks and did not have access to lab space. Consideration of these factors is of critical importance to the field of science education. Science instruction is heavily dependent upon access to materials, equipment, and lab space.

Future Questions

How does work autonomy differ for science teachers in the U.S. and China? This study provided initial data to show that, based on reports from teachers, differences exist for

levels of teacher autonomy in the two countries. For example, only two of the Chinese teachers were satisfied with their current levels of autonomy as compared to all of the U.S. teachers. The Chinese teachers referred to specific constraints related to the master syllabus and college entrance exams. To understand the context of these results further, visits to schools in China and the U.S. are needed in order to observe the school environments and to collect more data through interviews with teachers, students, and administrators.

How do autonomy and motivation affect middle school science teachers in other countries? This study used two countries that are prototypical examples of individualist and collectivist cultures. It is unclear what relationships might exist between autonomy and motivation in countries with cultures that are more moderate in terms of individualism and collectivism. Future research could replicate the basic design of this study in a variety of countries with different cultural and educational contexts.

How do increases in science teacher autonomy affect student motivation and learning? Previous studies have found that teachers enhance the intrinsic motivation of students when they provide students with opportunities to be autonomous in their learning (Black & Deci, 2000, Chirkov & Ryan, 2001; Deci, Nezlek, et al., 1981; Deci, Schwartz, et al., 1981). In turn, high levels of intrinsic motivation in students can result in improved engagement in tasks (Hagger, et al., 2005) and learning and understanding (Deci, et al. 1991). However, there is a dearth of research specific to science learning and autonomy. The teachers in this study reported that autonomy had a positive influence on students. They reported that students were more engaged and learned more when given autonomy over their learning. Future research should examine the impact of science teacher autonomy on student

motivation and learning. For example, little is known about how autonomy in science laboratories influences students' attitudes about inquiry.

This study supports previous research on the relationship between autonomy and motivation in educational and work settings. Despite vast differences in culture, educational systems, and work environments, the science teachers in this study indicated that autonomy played an important role in their motivation for work and that it influenced the types of instructional methods they used to teach science. The teachers were resolved that autonomy was integral to their abilities to individualize instruction to meet the needs of their students. In the words of Beth, "I think most teachers want the best for their children. Most teachers want to take them to higher levels. And they're professionals. They've been trained –many of them with master's and doctorate degrees." Following from Beth's advice, perhaps the best thing for all students is to let teachers do their jobs.

REFERENCES

- Anderson, L. W. (1987). The Decline of Teacher Autonomy - Tears or Cheers. *International Review of Education*, 33(3), 357-373.
- Bao, X. H., & Lam, S. F. (2008). Who makes the choice? Rethinking the role of autonomy and relatedness in Chinese children's motivation. *Child Development*, 79(2), 269-283.
- Berg, T. R., & Spinelli, L. (1974). Contemporary Threats to Teacher Autonomy. *Journal of Thought*, 9(4), 230-236.
- Black, A. E., & Deci, E. L. (2000). The effects of instructors' autonomy support and students' autonomous motivation on learning organic chemistry: A self-determination theory perspective. *Science Education*, 84(6), 740-756.
- Blais, M. R., Lachance, L., Vallerand, R. J., Briere, N. M., & Riddle, A. S. (1993). L'inventaire des motivations au travail de Blais [The Work Motivation inventory]. *Revue Que'becoise de Psychologie*, 14, 185-215.
- Bushnell, M. (2003). Teachers in the schoolhouse panopticon - Complicity and resistance. *Education and Urban Society*, 35(3), 251-272.
- Chirkov, V. I., & Ryan, R. M. (2001). Parent and teacher autonomy-support in Russian and US adolescents - Common effects on well-being and academic motivation. *Journal of Cross-Cultural Psychology*, 32(5), 618-635.
- Chirkov, V. I., Ryan, R. M., Kim, Y., & Kaplan, U. (2003). Differentiating autonomy from individualism and independence: A self-determination theory perspective on internalization of cultural orientations and well-being. *Journal of Personality and Social Psychology*, 84(1), 97-110.

- Chiu, C. Y., Hong, Y. Y., & Dweck, C. S. (1997). Lay dispositionism and implicit theories of personality. *Journal of Personality and Social Psychology*, 73(1), 19-30.
- Cordova, D. I., & Lepper, M. R. (1996). Intrinsic motivation and the process of learning: Beneficial effects of contextualization, personalization, and choice. *Journal of Educational Psychology*, 88(4), 715-730.
- Costello, A. B., & Osborne, J. W. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research & Evaluation*, 10(7), 1-9.
- Crawford, J. R. (2001). Teacher autonomy and accountability in charter schools. *Education and Urban Society*, 33(2), 186-200.
- Darland, D. D. (1970). Professions Quest for Responsibility and Accountability. *Phi Delta Kappan*, 52(1), 41-44.
- Deci, E. L. (1971). Effects of Externally Mediated Rewards on Intrinsic Motivation. *Journal of Personality and Social Psychology*, 18(1), 105-115.
- Deci, E. L. (1980). *The Psychology of Self-Determination*. Lexington, MA: Lexington Books.
- Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin*, 125(6), 627-668.
- Deci, E. L., Nezlek, J., & Sheinman, L. (1981). Characteristics of the Rewarder and Intrinsic Motivation of the Rwardee. *Journal of Personality and Social Psychology*, 40(1), 1-10.

- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic Motivation and Self-Determination in Human Behavior*. New York: Plenum Press.
- Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*(4), 227-268.
- Deci, E. L., Ryan, R. M., Gagne, M., Leone, D. R., Usunov, J., & Kornazheva, B. P. (2001). Need satisfaction, motivation, and well-being in the work organizations of a former eastern bloc country: A cross-cultural study of self-determination. *Personality and Social Psychology Bulletin, 27*(8), 930-942.
- Deci, E. L., Schwartz, A. J., Sheinman, L., & Ryan, R. M. (1981). An Instrument to Assess Adults Orientations toward Control Versus Autonomy with Children - Reflections on Intrinsic Motivation and Perceived Competence. *Journal of Educational Psychology, 73*(5), 642-650.
- Deci, E. L., Spiegel, N. H., Ryan, R. M., Koestner, R., & Kauffman, M. (1982). Effects of Performance Standards on Teaching Styles - Behavior of Controlling Teachers. *Journal of Educational Psychology, 74*(6), 852-859.
- Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. (1991). Motivation and Education - the Self-Determination Perspective. *Educational Psychologist, 26*(3-4), 325-346.
- Delandshere, G., & Petrosky, A. (2004). Political rationales and ideological stances of the standards-based reform of teacher education in the US. *Teaching and Teacher Education, 20*(1), 1-15.

- Flowerday, T., & Schraw, G. (2003). Effect of choice on cognitive and affective engagement. *Journal of Educational Research, 96*(4), 207-215.
- Fossati, A., Di Ceglie, A., Acquarini, E., & Barratt, E. S. (2001). Psychometric properties of an Italian version of the Barratt Impulsiveness Scale-11 (BIS-11) in nonclinical subjects. *Journal of Clinical Psychology, 57*(6), 815-828.
- Fulp, S. L. (2002). *Status of Middle School Science Teaching*: Horizon Research, Inc.
- Gagne, M., & Deci, E. L. (2005). Self-determination theory and work motivation. *Journal of Organizational Behavior, 26*(4), 331-362.
- Garson, G. D. (2010). Multiple regression. *Statnotes: Topics in Multivariate Analysis*
Retrieved March 29, 2010, from
<http://faculty.chass.ncsu.edu/garson/PA765/regress.htm#multicollinearity>
- Gess-Newsome, J., & Lederman, N. G. (1995). Biology Teachers Perceptions of Subject-Matter Structure and Its Relationship to Classroom Practice. *Journal of Research in Science Teaching, 32*(3), 301-325.
- Hagger, M. S., Chatzisarantis, N. L. D., Barkoukis, V., Wang, C. K. J., & Baranowski, J. (2005). Perceived autonomy support in physical education and leisure-time physical activity: A cross-cultural evaluation of the trans-contextual model. *Journal of Educational Psychology, 97*(3), 376-390.
- Haidt, J., Koller, S. H., & Dias, M. G. (1993). Affect, culture, and morality, or is it wrong to eat your dog. *Journal of Personality and Social Psychology, 65*(4), 613-628.
- Hofstede, G. (2001). *Culture's consequences* (2nd Edition ed.). London: Sage Publications.

- Ingersoll, R. M. (2001). Teacher turnover and teacher shortages: An organizational analysis. *American Educational Research Journal*, 38(3), 499-534.
- Ingersoll, R. M. (2007). Short on power, long on responsibility. *Educational Leadership*, 65(1), 20-25.
- Iyengar, S. S., & DeVoe, S. E. (2003). Rethinking the value of choice: Considering cultural mediators of intrinsic motivation. In V. B. J. J. MurphyBerman (Ed.), *Cross-Cultural Differences in Perspectives on the Self* (Vol. 49, pp. 129-174).
- Iyengar, S. S., & Lepper, M. R. (1999). Rethinking the value of choice: A cultural perspective on intrinsic motivation. *Journal of Personality and Social Psychology*, 76(3), 349-366.
- Jones, M. G., Jones, B. D., & Hargrove, T. Y. (2003). *The Unintended Consequences of High-Stakes Testing*. Lanham: Rowman & Littlefield Publishers, Inc.
- Katz, I., & Assor, A. (2007). When choice motivates and when it does not. *Educational Psychology Review*, 19(4), 429-442.
- Kitamura, T., Kishida, Y., Gatayama, R., Matsuoka, T., Miura, S., & Yamabe, K. (2004). Ryff's psychological well-being inventory: Factorial structure and life history correlates among Japanese university students. *Psychological Reports*, 94(1), 83-103.
- Lewis, J. L. (1962). An international comparison of science education. *Nature*, 194, 141-142.
- Lynch, M. F., La Guardia, J. G., & Ryan, R. M. (2009). On being yourself in different cultures: Ideal and actual self-concept, autonomy support, and well-being in China, Russia, and the United States. *The Journal of Positive Psychology*, 4(4), 290-304.

- Markus, H. R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation *Psychological Review*, 98(2), 224-253.
- McDonald, M. (2002). The perceived role of diploma examinations in Alberta, Canada. *Journal of Educational Research*, 96(1), 21-36.
- Ministry of Education of the People's Republic of China. (2008a). Full-time teachers in junior secondary schools broken down by rank and age Retrieved February 28, 2010, from http://translate.googleusercontent.com/translate_c?hl=en&sl=zh-CN&tl=en&u=http://www.moe.gov.cn/edoas/website18/68/info1261644578968368.htm&rurl=translate.google.com&usg=ALkJrhhpWJox3mHTVEKgVsfwZNQYDihDbA
- Ministry of Education of the People's Republic of China. (2008b). Number of full-time junior secondary school teachers by subject taught and educational attainment Retrieved February 28, 2010, from http://translate.googleusercontent.com/translate_c?hl=en&sl=zh-CN&tl=en&u=http://www.moe.gov.cn/edoas/website18/67/info1261644374221367.htm&rurl=translate.google.com&usg=ALkJrhAzf9M3u4o3dqa_8g8O2MzLDP8gw
- Mustafa, M., & Cullingford, C. (2008). Teacher autonomy and centralised control: The case of textbooks. *International Journal of Educational Development*, 28(1), 81-88.
- National Research Council. (1996). *The national science education standards*. Washington, DC: National Academy Press.
- National Research Council. (2000). *Inquiry and the national science education standards*. Washington, DC: National Academy Press.

- Paton, J. M. (1970). Movements toward Teacher Autonomy in Canada. *Phi Delta Kappan*, 52(1), 45-49.
- Pelletier, L. G., Seguin-Levesque, C., & Legault, L. (2002). Pressure from above and pressure from below as determinants of teachers' motivation and teaching behaviors. *Journal of Educational Psychology*, 94(1), 186-196.
- Poole, W. L. (2008). Intersections of organizational justice and identity under the new policy direction: important understandings for educational leaders. *International Journal of Leadership in Education*, 11(1), 23-42.
- Reeve, J., Bolt, E., & Cai, Y. (1999). Autonomy-supportive teachers: How they teach and motivate students. *Journal of Educational Psychology*, 91, 537-548.
- Ryan, A. M., Chan, D., Ployhart, R. E., & Slade, L. A. (1999). Employee attitude surveys in a multinational organization: Considering language and culture in assessing measurement equivalence. *Personnel Psychology*, 52(1), 37-58.
- Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology*, 57(5), 749-761.
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68-78.
- Samuels, J. J. (1970). Impingements on Teacher Autonomy. *Urban Education*, 5(2), 152-171.

- Sheldon, K. M., & Biddle, B. J. (1998). Standards, accountability, and school reform: Perils and pitfalls. *Teachers College Record, 100*(1), 164-180.
- Tekleselassie, A. A. (2005). Teachers' career ladder policy in Ethiopia: an opportunity for professional growth or "a stick disguised as a carrot?". *International Journal of Educational Development, 25*(6), 618-636.
- Tremblay, M. A., Blanchard, C. I. M., Taylor, S., Pelletier, L. G., & Villeneuve, M. (2009). Work Extrinsic and Intrinsic Motivation Scale: Its value for organizational psychology research. *Canadian Journal of Behavioural Science, 41*(4), 213-226.
- Triandis, H. C., Bontempo, R., Villareal, M. J., Asai, M., & Lucca, N. (1988). Individualism and collectivism: Cross-cultural perspectives on self ingroup relationships *Journal of Personality and Social Psychology, 54*(2), 323-338.
- Upadhyay, B., Calabrese Barton, A., & Zahur, R. (2005). Teaching science in a poor urban school in Pakistan: Tensions in the life history of a female elementary teacher. *Science Education, 89*, 725-743.
- Vallerand, R. J., Blais, M. R., Briere, N. M., & Pelletier, L. G. (1989). Construction et validation de l'Échelle de Motivation en Éducation (EME). *Revue Canadienne des Sciences du Comportement, 21*, 323-349.
- Vallerand, R. J., Pelletier, L. G., Blais, M. R., Briere, N. M., Senecal, C., & Vallieres, E. F. (1992). The Academic Motivation Scale: A measure of intrinsic, extrinsic, and amotivation in education. *Educational and Psychological Measurement, 52*(4), 1003-1017.

- Vallerand, R. J., Pelletier, L. G., Blais, M. R., Briere, N. M., Senecal, C., & Vallieres, E. F. (1993). On the assessment of intrinsic, extrinsic, and amotivation in education - evidence of the concurrent and construct-validity of the Academic Motivation Scale. *Educational and Psychological Measurement, 53*(1), 159-172.
- van Veen, K., Slegers, P., Bergen, T., & Klaassen, C. (2001). Professional Orientations of Secondary School Teachers Towards Their Work. *Teaching and Teacher Education, 17*(2), 175-194.
- Wei, B. (2009). In search of meaningful integration: The experiences of developing integrated science curricula in junior secondary schools in China. *International Journal of Science Education, 31*(2), 259-277.
- Wills, J. S., & Haymore Sandholtz, J. (2009). Constrained professionalism: Dilemmas of teaching in the face of test-based accountability. *Teachers College Record, 111*, 1065-1114.
- Yeom, M., & Ginsburg, M. (2007). Professionalism and the reform of teachers and teacher education in the republic of Korea & the United States of America. *Asia Pacific Education Review, 8*(2), 298-310.

APPENDICES

APPENDIX A: Science Teacher Autonomy Survey

1. Participant Information

The purpose of this survey is to collect information about teachers' perceptions of autonomy and its effects on teaching. All responses will be kept confidential and be used to report trends in teacher autonomy.

PLEASE complete all sections of the Participant Information and the four surveys.

1. What is your age?

2. What is your gender?

- Male
 Female

3. What is your race/ ethnicity?

- African American
 Asian or Pacific Islander
 Hispanic
 Native American
 White (not Hispanic)

4. Do you consider yourself a native of the country in which you are currently teaching?

- Yes
 No

5. If you answered "No" to the previous question, of what country are you a native?

6. Do you hold a current teaching certificate or licensure?

- Yes
 No

7. If you answered "Yes" to the previous question, what is the highest level of teaching certification or licensure that you have earned?

- Regular Licensure
- Lateral Entry
- Master's
- 6-Year Licensure
- Ph.D./Ed.D.
- NBPTS (National Boards)

8. What are the ages of the students that you teach? (You may select more than one age.)

- 10
- 11
- 12
- 13
- 14

9. How many years of teaching experience do you have?

- 0-10
- 11-20
- 21-30
- 31-40
- More than 40

10. How many computers do students have access to in your classroom?

11. How many computers do students have access to in your school?

12. Which category best describes the community in which you teach?

- Rural (less than 500 people/square mile)
- Suburban (500 people/square mile)
- Urban (1,000 people/square mile)

13. Do you teach at a public or private school?

Public

Private

2. Constraints at Work

Perception of Work Climate

14. Indicate to what extent each of the following statements corresponds to your working conditions.

	Does not correspond at all (1)	(2)	(3)	Corresponds moderately (4)	(5)	(6)	Corresponds very strongly (7)
a. It is important to cover the whole curriculum.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. You feel supported by school administrators.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Your students are interested in the material.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Your students' parents criticize your teaching.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. You must adhere to the teaching methods of your colleagues.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. All the students in the class must progress at the same rate.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. You must participate in extracurricular duties.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. You have some freedom in defining your curriculum.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. You must encourage your students to do their homework.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. It is important that your students have good productivity.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. You feel free to participate in extracurricular duties of your choice.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
l. You must regularly evaluate your students.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
m. You must limit the number of failures for a class.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
n. You are evaluated according to the "control" that you have over your class.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
o. It is important that your students have fun learning.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
p. You are evaluated according to your student's level of satisfaction.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
q. Your colleagues support initiatives that you undertake in your teaching.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
r. You are supported by your students' parents.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
s. Your students' parents support your teaching methods.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Survey developed by Pelletier, Sequin-Levesque, and Legault in 2002.

3. Perceptions of Students' Motivation

Why do your students go to school?

15. Using the scale below, indicate to what extent each of the following items presently corresponds to one of the reasons why your students go to school.

	Does not correspond at all (1)	(2)	(3)	Corresponds moderately (4)	(5)	(6)	Corresponds very strongly (7)
a. Because I need at least a high-school degree in order to find a high-paying job later on.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Because I experience pleasure and satisfaction while learning new things.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Because I think that a high-school education will help me better prepare for the career I have chosen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Because I really like going to school.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Honestly, I don't know; I really feel that I am wasting my time in school.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. For the pleasure I experience while surpassing myself in my studies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. To prove to myself that I am capable of completing my high-school degree.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. In order to obtain a more prestigious job later on.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. For the pleasure I experience when I discover new things never seen before.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. Because eventually it will enable me to enter the job market in a field that I like.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. Because for me, school is fun.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
l. I once had good reasons for going to school; however, now I wonder whether I should continue.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
m. For the pleasure that I experience while I am surpassing myself in one of my personal accomplishments.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
n. Because of the fact that when I succeed in school I feel important.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
o. Because I want to have "the good life" later on.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
p. For the pleasure that I experience in broadening my knowledge about subjects which appeal to me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
q. Because this will help me make a better choice regarding my career orientation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
r. For the pleasure that I experience when I am taken by discussions with interesting teachers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
s. I can't see why I go to school and frankly, I couldn't care less.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
t. For the satisfaction I feel when I am in the process of accomplishing difficult academic activities.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
u. To show myself that I am an intelligent person.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
v. In order to have a better salary later on.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
w. Because my studies allow me to continue to learn about many things that interest me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
x. Because I believe that my high school education will improve my competence as a worker.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

- | | | | | | | | |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| y. For the "high" feeling that I experience while reading about various interesting subjects. | <input type="radio"/> |
| z. I don't know; I can't understand what I am doing in school. | <input type="radio"/> |
| aa. Because high school allows me to experience a personal satisfaction in my quest for excellence in my studies. | <input type="radio"/> |
| bb. Because I want to show myself that I can succeed in my studies. | <input type="radio"/> |

Survey developed by Vallerand, Pelletier, Blais, Briere, Senecal, and Vallieres in 1992.

4. The Work Motivation Inventory

Why do you do your work?

16. Using the scale below, please indicate to what extent each of the following items corresponds to the reasons why you are presently involved in your work.

	Does not correspond at all (1)	(2)	(3)	Corresponds moderately (4)	(5)	(6)	Corresponds very strongly (7)
a. Because this is the type of work I chose to do in order to attain a certain lifestyle.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. For the income it provides me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. I ask myself this question, I don't seem to be able to manage the important tasks related to this work.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Because I derive much pleasure from learning new things.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Because it has become a fundamental part of who I am.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Because I want to succeed at this job, if not I would be very ashamed of myself.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Because I chose this type of work to attain my career goals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. For the satisfaction I experience from taking on interesting challenges.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. Because it allows me to earn money.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. Because it is part of the way in which I have chosen to live my life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. Because I want to be very good at this work, otherwise I would be very disappointed.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
l. I don't know why, we are provided with unrealistic working conditions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
m. Because I want to be a winner in life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
n. Because it is the type of work I have chosen to attain certain important objectives.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
o. For the satisfaction I experience when I am successful at doing difficult tasks.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
p. Because this type of work provides me with security.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
q. I don't know, too much is expected of us.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
r. Because this job is a part of my life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Survey developed by Tremblay, Blanchard, Taylor, and Pelletier (in press).

5. The Problems in Schools Questionnaire

On the following pages you will find a series of vignettes. Each one describes an incident and then lists four ways of responding to the situation. Please read each vignette and then consider each of the responses in turn. Think about each response option in terms of how appropriate you consider it to be as a means of dealing with the problem described in the vignette. You might consider the option to be "perfect," in other words, "very appropriate," in which case you would respond with the number 7. You might consider the response highly inappropriate, in which case you would respond with the number 1. If you find the option reasonable you would select some number between 1 and 7. So think about each option and rate it on the scale shown below. Please rate each of the four options for each vignette. There are eight vignettes with four options for each.

There are no right or wrong ratings on these items. People's styles differ, and we are simply interested in what you consider appropriate given your own style.

Some of the stories ask what you would do as a teacher. Others ask you to respond as if you were giving advice to another teacher or to a parent. Some ask you to respond as if you were the parent. If you are not a parent, simply imagine what it would be like for you in that situation.

Please respond to each of the 32 items using the following scale.

17. Jim is an average student who has been working at grade level. During the past two weeks he has appeared listless and has not been participating during reading group. The work he does is accurate but he has not been completing assignments. A phone conversation with his mother revealed no useful information. The most appropriate thing for Jim's teacher to do is:

	Very inappropriate (1)	(2)	(3)	Moderately appropriate (4)	(5)	(6)	Very appropriate (7)
a. She should impress upon him the importance of finishing his assignments since he needs to learn this material for his own good.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Let him know that he doesn't have to finish all of his work now and see if she can help him work out the cause of the listlessness.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Make him stay after school until that day's assignments are done.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Let him see how he compares with the other children in terms of his assignments and encourage him to catch up with the others.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

18. At a parent conference last night, Mr. and Mrs. Greene were told that their daughter Sarah has made more progress than expected since the time of the last conference. All agree that they hope she continues to improve so that she does not have to repeat the grade (which the Greene's have been kind of expecting since the last report card). As a result of the conference, the Greens decide to:

	Very inappropriate (1)	(2)	(3)	Moderately appropriate (4)	(5)	(6)	Very appropriate (7)
a. Increase her allowance and promise her a ten-speed if she continues to improve.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Tell her that she's now doing as well as many of the other children in her class.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Tell her about the report, letting her know that they're aware of her increased independence in school and at home.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Continue to emphasize that she has to work hard to get better grades.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

19. Donny loses his temper a lot and has a way of agitating other children. He doesn't respond well to what you tell him to do and you're concerned that he won't learn the social skills he needs. The best thing for you to do with him is:

	Very inappropriate (1)	(2)	(3)	Moderately appropriate (4)	(5)	(6)	Very appropriate (7)
a. Emphasize how important it is for him to "control himself" in order to succeed in school and in other situations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Put him in a special class which has the structure and reward contingencies which he needs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Help him see how other children behave in these various situations and praise him for doing the same.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Realize that Donny is probably not getting the attention he needs and start being more responsive to him.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20. Your son is one of the better players on his junior soccer team which has been winning most of its games. However, you are concerned because he just told you he failed his unit spelling test and will have to retake it the day after tomorrow. You decide that the best thing to do is:

	Very inappropriate (1)	(2)	(3)	Moderately appropriate (4)	(5)	(6)	Very appropriate (7)
a. Ask him to talk about how he plans to handle the situation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Tell him he probably ought to decide to forego tomorrow's game so he can catch up in spelling.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. See if others are in the same predicament and suggest he do as much preparation as the others.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Make him miss tomorrow's game to study; soccer has been interfering too much with his school work.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6. The Problems in Schools Questionnaire continued

21. The Rangers spelling group has been having trouble all year. How could Miss Wilson best help the Rangers?

	Very inappropriate (1)	(2)	(3)	Moderately appropriate (4)	(5)	(6)	Very appropriate (7)
a. Have regular spelling bees so that Rangers will be motivated to do as well as the other groups.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Make them drill more and give them special privileges for improvements.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Have each child keep a spelling chart and emphasize how important it is to have a good chart.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Help the group devise ways of learning the words together (skits, games, and so on).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

22. In your class is a girl named Margy who has been the butt of jokes for years. She is quiet and usually alone. In spite of the efforts of previous teachers, Margy has not been accepted by the other children. Your wisdom would guide you to:

	Very inappropriate (1)	(2)	(3)	Moderately appropriate (4)	(5)	(6)	Very appropriate (7)
a. Prod her into interactions and provide her with much praise for any social initiative.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Talk to her and emphasize that she should make friends so she'll be happier.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Invite her to talk about her relations with the other kids, and encourage her to take small steps when she's ready.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Encourage her to observe how other children relate and to join in with them.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

23. For the past few weeks things have been disappearing from the teacher's desk and lunch money has been taken from some of the children's desks. Today, Marvin was seen by the teacher taking a silver dollar paperweight from her desk. The teacher phoned Marvin's mother and spoke to her about this incident. Although the teacher suspects that Marvin has been responsible for the other thefts, she mentioned only the one and assured the mother that she'll keep a close eye on Marvin. The best thing for the mother to do is:

	Very inappropriate (1)	(2)	(3)	Moderately appropriate (4)	(5)	(6)	Very appropriate (7)
a. Talk to him about the consequences of stealing and what it would mean in relation to the other kids.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Talk to him about it, expressing her confidence in him and attempting to understand why he did it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Give him a good scolding; stealing is something which cannot be tolerated and he has to learn that.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Emphasize that it was wrong and have him apologize to the teacher and promise not to do it again.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

24. Your child has been getting average grades, and you'd like to see her improve. A useful approach might be to:

	Very inappropriate (1)	(2)	(3)	Moderately appropriate (4)	(5)	(6)	Very appropriate (7)
a. Encourage her to talk about her report card and what it means for her.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Go over the report card with her; point out where she stands in the class.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Stress that she should do better; she'll never get into college with grades like these.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Offer her a dollar for every A and 50 cents for every B on future report cards.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Survey developed by Deci, Schwartz, and Ryan in 1981.

7. Survey Conclusion

THANK YOU for completing the survey! Your time and effort are greatly appreciated.

Earn a \$25 GIFT CARD for participating in Part 2 of the study.

If you are interested in participating in Part 2 of the study which involves a brief phone interview, please email the researcher Laura Robertson (lrobert@ncsu.edu). She will contact you through email with details about the interview. Participants who complete Part 2 of the study will receive a gift card valued at \$25 US dollars. Twenty volunteers will be interviewed in Part 2 of the study. As with the online survey, your participation is voluntary, you may choose not to answer any questions that make you feel uncomfortable, and you can withdraw from the study at any time.

APPENDIX B: Chinese Translation of Science Teacher Autonomy Survey (English Translations Located in Appendices A, C, and D)

1. 第一部份： 问卷调查简介及个人资料

本次问卷是为了收集关于老师对自主性的看法及其看法对教学的影响。本问卷所有的结果只作团体性的分析，不作个别呈现，且对外绝对保密。请填写所有部份，包括个人资料及四份问卷。

1. 年龄：

2. 性别：

男

女

3. 籍贯：您属于本省人吗？（即您所教授的学校在你的本省）

是

否

4. 如果上一题您回答了“否”，那么您生于哪个省份？

5. 您现在持有教师资格证吗？

是

否

6. 您拥有本科以上学历吗？

是

否

7. 如果上一题您回答了“是”，那么您的学历是：

8. 您教导的学生年龄分布：（可以多选。）

10

11

12

13

14

9. 您的教龄:

- 0-10
- 11-20
- 21-30
- 31-40
- 超过 40

10. 在您的课堂上, 有多少台电脑可提供给学生使用?

11. 在您的学校里, 有多少台电脑可提供给学生使用?

12. 您会把您的学校所在位置分类为:

- 城市
- 郊区
- 农村

13. 您任教的学校是公立学校吗?

- 是
- 否

2. 第二部份：工作上的约束或限制

请圈选最适当的数字，以反映您对您目前工作情况的认同。

14. 请圈选最适当的数字，以反映您对您目前工作情况的认同。

	极不赞同 (1)	(2)	(3)	赞同 (4)	(5)	(6)	极赞同 (7)
a. 涵盖全部课程是重要的。	<input type="radio"/>						
b. 你感受到学校行政人员对你的支持。	<input type="radio"/>						
c. 你的学生对学习材料感兴趣。	<input type="radio"/>						
d. 你的教学遭到学生家长的批评。	<input type="radio"/>						
e. 你必须追随同校老师们的教学方式。	<input type="radio"/>						
f. 班里所有学生的学习进展速度都必须相同。	<input type="radio"/>						
g. 你必须参与学校的课外活动工作。	<input type="radio"/>						
h. 你有一定的自由去规划你的课程。	<input type="radio"/>						
i. 你必须鼓励学生做家庭作业。	<input type="radio"/>						
j. 你的学生充成功课是重要的。	<input type="radio"/>						
k. 你可以随意选择是否参与学校的课外活动工作。	<input type="radio"/>						
l. 你必须定期评估学生们情况。	<input type="radio"/>						
m. 你必须限制班中不合格学生或在课堂上学习失败的学生数目。	<input type="radio"/>						
n. 学校根据你是否有效去控制班中纪律来评估你的教学能力。	<input type="radio"/>						
o. 你的学生学习时感到愉快是重要的。	<input type="radio"/>						
p. 学校根据你的学生的满意程度来评估你的教学能力。	<input type="radio"/>						
q. 你的同事支持你所倡议的教学方式。	<input type="radio"/>						
r. 你得到学生家长的支持。	<input type="radio"/>						
s. 你的学生家长支持你的教学方法。	<input type="radio"/>						

该调查问卷由佩尔提埃莱布斯克和莱格特创于2002年。

3. 第三部份： 学生对学习动机的知觉感受

为什么你的学生们要去学校？

15. 请圈选最适当的数字，以描述你的大多数学生要去学校的原因。

	非常不赞同 (1)	(2)	(3)	赞同(4)	(5)	(6)	非常赞同 (7)
a. 因为我(学生) 至少需要拥有高中学历以便将来可找到一份高收入的工作。	<input type="radio"/>						
b. 当我学习新事物时，感到愉快及满足。	<input type="radio"/>						
c. 我觉得高中教育能够训练和帮助我胜任将来的工作。	<input type="radio"/>						
d. 因为我真的很喜欢到学校去。	<input type="radio"/>						
e. 说实在的，我不知道为何要到学校，我感到浪费时间。	<input type="radio"/>						
f. 在学校里我可以超越自我，感到无比乐趣。	<input type="radio"/>						
g. 我要向我自己证明我有能力修毕高中课程。	<input type="radio"/>						
h. 将来能够获得一份令人尊敬的工作。	<input type="radio"/>						
i. 当学习到一些全新事物时，我感到无比乐趣。	<input type="radio"/>						
j. 最终会引领我找到我喜欢的职业。	<input type="radio"/>						
k. 对我而言，上学很有乐趣。	<input type="radio"/>						
l. 我曾经有很好的理由支持我去上学，可是现在我在纳闷(或感到疑惑)不知应不应该继续下去。	<input type="radio"/>						
m. 当我在个人成就上超越自己，我会十分高兴。	<input type="radio"/>						
n. 当我在学校取得成功，我感觉自己是一个很重要的人。	<input type="radio"/>						
o. 我想将来能够得到很好的生活。	<input type="radio"/>						
p. 在学习我感兴趣的科目时，开阔我的知识领域，我感到十分高兴。	<input type="radio"/>						
q. 上学使我更有效地选择将来的终身职业。	<input type="radio"/>						
r. 当我跟喜欢的老师讨论问题时，我感到愉快。	<input type="radio"/>						
s. 我不知道为什么要上学，而且毫不在乎。	<input type="radio"/>						
t. 我很享受克服有挑战性的学术活动的过程，并感到满足。	<input type="radio"/>						
u. 我要让自己知道我是个有智慧的人。	<input type="radio"/>						
v. 以后可以找到一份工资高的工作。	<input type="radio"/>						
w. 学校可以让我继续学到我感兴趣的事情。	<input type="radio"/>						
x. 我相信高中教育可以提高我的工作能力。	<input type="radio"/>						
y. 当我阅读一些有趣的课题时，我会有兴奋的感觉。	<input type="radio"/>						
z. 我不知道为何要上学，也不明白我在这里做什么。	<input type="radio"/>						
aa. 因为在追求卓越的学习过程中，高中生活带给我个人满足感。	<input type="radio"/>						
bb. 我想向我自己表明我是可以在学习中取得成功的。	<input type="radio"/>						

该调查问卷由瓦勒朗，佩尔蒂埃，布萊斯，布里耶尔，塞内卡尔和瓦利耶尔创立于1992年。

4. 第四部份： 工作动机

为什么您要做这份工作？

16. 请圈选最适当的数字，以描述您个人选择这份工作的原因。

	非常不赞同 (1)	(2)	(3)	赞同 (4)	(5)	(6)	非常赞同 (7)
a. 我选择这类型的工作以获得某种生活方式。	<input type="radio"/>						
b. 为了现在的工资。	<input type="radio"/>						
c. 我也在问自己这个问题，我看不到自己可以做好这份工作，尤其是一些相关的重要任务。	<input type="radio"/>						
d. 我从学习新事物中获得很大乐趣。	<input type="radio"/>						
e. 这份工作已经成为建立我的人生过程中的基本部分。	<input type="radio"/>						
f. 我想在这份工作上取得成功，否则会感到十分羞愧。	<input type="radio"/>						
g. 我选择这样的工作是为了达到我的工作目标。	<input type="radio"/>						
h. 在承担有意思的挑战时，我感到十分满足。	<input type="radio"/>						
i. 因为这份工作令我可以赚取收入。	<input type="radio"/>						
j. 这是其中一个方法使我才可以选择自己想要的生活。	<input type="radio"/>						
k. 我想把这份工作做得很出色，否则我会十分失望。	<input type="radio"/>						
l. 我不知道为什么我们的工作环境(或条件)是不切实际的。	<input type="radio"/>						
m. 我想成为生活中的强者。	<input type="radio"/>						
n. 我选择这类型的工作来达到某些重要的目标。	<input type="radio"/>						
o. 当我成功地完成一些困难的工作，我感到满足。	<input type="radio"/>						
p. 因为这类型的工作带给我安全。	<input type="radio"/>						
q. 不知道，这份工作要求实在太高。	<input type="radio"/>						
r. 这份工作已成为我生活中的一部份。	<input type="radio"/>						

该调查问卷由特伦布莱，查德，泰勒和佩尔蒂埃所创（尚未发表）。

5. 第五部份：学校里发生的问题

下一页您会看到一些小故事。描述每段故事后，会列出四个不同的解决方法。请仔细阅读每段故事，然后把四个方法分别考虑一下。在考虑的过程中，想想如何才是最合理的方法去解决当中遇到的问题。如果您觉得其中一个方案是极好的，请填写7。如果您觉得那个方法是极差的，请填写1。如果您觉得那个方法是合理的，请选择1至7当中的数字去表达不同程度的认同。认真思考每个方案，然后利用以下等级去一一评分。答案中无所谓对与错--每个人都有自己处理问题的风格。我们期待知道您个人的看法，所以请圈选您认为最适当的数字。

当中的小故事有些是以您作为老师的第一身份去评分，有些是问您如何给其他老师或家长意见，有些则是试以家长的角度去评分。如您本人并非家长，可以试想像如果您是家长您会如何处理问题，然后再作评分。

这部份共有32个项目，请为每项答案逐一评分。

17. 国强的学习成绩一般。在最近的两周，他常常表现得没精打采，提不起劲去参与班中的阅读小组。虽然他的功课都是正确无误，但是并没有把所有的功课都交齐。老师与他母亲的电话交谈也没有提供有用的信息。国强的老师要怎么样处理才最合适呢？

	极不恰当的 (1)	(2)	(3)	恰当的 (4)	(5)	(6)	非常恰当的 (7)
a. 国强老师应该要他牢牢记住完成功课的重要性，因为他所学到的知识都是为他好的。	<input type="radio"/>						
b. 让他知道现在并不一定要他交齐功课，试图了解他为什么提不起劲去学习。	<input type="radio"/>						
c. 要求他课后留校直到把当天的功课完成为止。	<input type="radio"/>						
d. 把他的情况跟其他同学比较，鼓励国强努力学习追赶追上其他同学。	<input type="radio"/>						

18. 昨晚陈先生和太太出席了学校举办的家长讨论会，他们谈到女儿晓晖的学习情况，成绩比去年有显著进步。他们希望女儿能继续努力，取得好成绩就不用重读（注：因为上次派成绩表的时候，陈先生觉得晓晖的成绩不好，可能要重读）。最后在讨论会完结之前，陈先生和太太有以下决定：

	极其不恰当的 (1)	(2)	(3)	恰当 (4)	(5)	(6)	非常恰当 (7)
a. 如果女儿晓晖学习上继续进步，会增加她的零用钱和承诺给她买一辆最新的自行车。	<input type="radio"/>						
b. 告诉她现在她的成绩跟班里许多其他同学一样好。	<input type="radio"/>						
c. 跟她讨论最新的成绩表，让她知道父母已经意识到她在学校和在家里的独立性都有所提高。	<input type="radio"/>						
d. 继续强调她要努力读书，从而取得更好的成绩。	<input type="radio"/>						

19. 董卓很容易发脾气，常常使其他同学感到不安。他对你的教导也并不在意。你很担心他这样下去会没法学好正常社交生活的技能。你认为应该怎样帮助他才是最好的呢？

	极其不恰当的 (1)	(2)	(3)	恰当 (4)	(5)	(6)	非常恰当 (7)
a. 强调如果他想在学校和其他环境中取得成功，他必须了解控制自己的重要性。	<input type="radio"/>						
b. 把他转送到特殊班，使他能在他所需要的环境和奖励制度下学习。	<input type="radio"/>						
c. 协助他去分析其他同学处理问题时的行为反应，如果他做得对，会尽量去表扬他。	<input type="radio"/>						
d. 认识到董卓可能得不到应有的关注，所以会多去回应他的需要。	<input type="radio"/>						

20. 你的儿子热爱课外活动。可是，他刚告诉你他的英文单词考试不合格，老师要求他后天重考。你觉得怎样做才是最好呢？

	极其不恰当 (1)	(2)	(3)	恰当 (4)	(5)	(6)	非常恰当 (7)
a. 让儿子谈谈他打算怎样去处理现在的情况。	<input type="radio"/>						
b. 告诉他可能要放弃课外活动，好好补习英文词汇。	<input type="radio"/>						
c. 看看有没有其他同学跟他的情况一样，建议他要像其他人一样来准备考试。	<input type="radio"/>						
d. 要求他停止他的课外活动，因为这些课外活动太妨碍他的学习工作	<input type="radio"/>						

6. 第五部份：学校里发生的问题(续)

21. 班里的一个单词学习小组表现今年一直不尽人意。你认为韦老师应该怎样去帮助这一批成员？

	极其不恰当 (1)	(2)	(3)	恰当 (4)	(5)	(6)	非常恰当 (7)
a. 定期举办单词听写比赛，激发小组成员去赶上其他小组。	<input type="radio"/>						
b. 加强训练，当取得进步时，提供特别奖励。	<input type="radio"/>						
c. 要求每个小组成员必须要有一个单词表，并强调一个好的单词表的重要性。	<input type="radio"/>						
d. 帮助小组成员设计多元化的训练方式，如话剧、游戏等，去帮助他们学习更多词汇。	<input type="radio"/>						

22. 你班中有一位女生小美多年来都是全班的笑柄。她性格安静，常常独自一人。小美以前的老师都尽力去帮助她，但是仍然得不到同学们的接受。依你所见，应如何处理？

	极其不恰当 (1)	(2)	(3)	恰当 (4)	(5)	(6)	非常恰当 (7)
a. 督促小美多与同学交流，当她主动结交朋友时，对她提出表扬。	<input type="radio"/>						
b. 与她交谈，强调结交朋友会使她变得更快乐。	<input type="radio"/>						
c. 请她谈谈与其他同学的相处，当小美准备好的时候，鼓励她慢慢主动放开心怀结交朋友。	<input type="radio"/>						
d. 鼓励她多观察其他同学如何处理人际关系，并尝试参与其中。	<input type="radio"/>						

23. 在过去的几个星期里，老师办公桌上的东西以及同学们书桌上的午餐钱都一一离奇失踪。今天，有老师看见马小明从她的办公桌上取去一个银镇尺。老师便致电小明的母亲并告诉她关于这件事。虽然老师怀疑小明可能牵涉其他的偷窃事件，可是她只向其母亲提及银镇尺的事，并保证会多留意小明的举动。你认为小明母亲应该怎样做才是最好呢？

	极其不恰当 (1)	(2)	(3)	恰当 (4)	(5)	(6)	非常恰当 (7)
a. 与小明谈论关于偷窃的后果，并引导他知道这种行为会怎样影响其他同学。	<input type="radio"/>						
b. 与小明谈论这件事，表达对他的信心及尝试了解他做这件事的原因。	<input type="radio"/>						
c. 狠狠地教训他一顿：偷窃是不能容忍的，他必须学懂这个教训。	<input type="radio"/>						
d. 强调这种行为是错误的，他需要和老师道歉并承诺以后都不会这样做。	<input type="radio"/>						

24. 你孩子的学业成绩只是一般，你想看到她有更大的进步。你认为怎么样的应付方法是最有效？

	极其不恰当 (1)	(2)	(3)	恰当 (4)	(5)	(6)	非常恰当 (7)
a. 鼓励她谈论其成绩单，听听她对成绩单意义的看法。	<input type="radio"/>						
b. 与她一同把成绩单读一遍，指出她在班中的排名。	<input type="radio"/>						
c. 强调她必须把学习做得更好，要不然，以她这样的成绩永远也进不到大学的。	<input type="radio"/>						
d. 如果她在未来的成绩单中获得甲级成绩便可得到10元，乙级成绩可得到5元。	<input type="radio"/>						

该调查问卷由戴斯，施瓦茨和瑞恩创于1981年。

7. 总结

感谢您参与本问卷调查及提供宝贵意见！所有内容将会受到严格保密。

本研究第二部分将包括一个简短的问答，如果您感兴趣请发电子邮件（中英文皆可）给劳拉·罗伯逊。她的电子邮件地址为 lerobert@ncsu.edu。她将电邮告知您问答细节。问答将通过电话或网络连线,在第三方翻译帮助下进行。完成第二部分调查的参与者将获得价值25美元（约人民币170元）的卓越亚马逊购物卡。该部分共需要20位志愿者。本部分属自愿，您可以拒绝回答任何一个问题或退出该问卷。

再次感谢您的参与。

APPENDIX C: English Translation of Chinese Science Teacher Autonomy Survey,
Participant Information Section

1. Participant Information

The purpose of this survey is to collect information about teachers' perceptions of autonomy and its effects on teaching. All responses will be kept confidential and be used to report trends in teacher autonomy.

PLEASE complete all sections of the Participant Information and the four surveys.

1. What is your age?
2. What is your gender? Male Female
3. Were you born in the province that you are currently teaching?
4. If you answered no for the last question, where are you from?
5. Do you hold a current teaching certificate or licensure? Yes___ No___
6. Do you have a degree above the Bachelor's? Yes___ No___
7. If you answered yes for the last question, what is your degree? ___
8. What are the ages of the students that you teach?
9. How many years of teaching experience do you have?
10. How many computers do students have access to in your classroom?
11. How many computers do students have access to in your school?
12. Which category best describes the community in which you teach?
 - 1) Rural
 - 2) Suburban
 - 3) Urban
13. Do you teach in a government-run school/Do you teach in a public school run by the government? Yes _____ No _____

- d. The teacher makes a comparison between Guoqiang and other students, and encourages him to work harder to catch up with his peers.

18. Mr. and Mrs. Chen attended a parent-teacher conference last night. They talked about how their daughter, Xiaohui, had been doing in school. They believed Xiaohui had been doing much better than last year, hoping that she would keep it up so she wouldn't need to repeat the grade level next year (note: After seeing Xiaohui's most recent report card last time, Mr. Chen thought that Xiaohui would probably need to repeat the grade level next year.) Before the end of the conference last night, Mr. and Mrs. Chen decided that:

- a. They would give Xiaohui more pin money and also buy her a new bicycle if she keeps making progress.
- b. They would tell Xiaohui that she is now doing as well as her peers.
- c. They would discuss her current grades with her, letting her know that they have been aware of her progress to study independently both in school and at home.
- d. They would continue emphasize (to Xiaohui) the importance of working hard to achieve better grades.

19. Zhuo Dong has a short temper and often upsets his classmates. He doesn't listen to you when you try to help him. You are worried about his ability to get along with others if he keeps acting this way. How would you help him?

- a. Emphasize to him the importance of controlling his emotions if he wants to succeed in school and other places.
- b. Place him in a special class so that he could receive the care and the study condition he needs.
- c. Help him analyze how other students react to and solve problems. When he is doing the right thing, try to praise him as much as possible.
- d. Recognize that Zhuo Dong is probably not getting the attention he needs in other places, and be willing to be more responsive to him.

20. Your son enjoys extracurricular activities. But he just told you that he had failed the English vocabulary test, and needs to retake it the day after tomorrow. What would you do now?

- a. Ask him how he plans to deal with this situation.
- b. Tell him that he probably needs to give up playing in tomorrow's soccer game so he can catch up in vocabulary.
- c. Find out if there are any other students who are in a similar situation, and suggest that he needs to do as much preparation as the others.
- d. Require him to give up his extracurricular activities and to study at home, because they are affecting his grades.

21. The vocabulary study group has not been doing very well this year. How should Mr. Wei help the group?

- a. Have regular vocabulary competitions so that the team members will be motivated to do as well as other groups.
- b. Provide more practice and special privileges for improvement.
- c. Require each team member to have a word list and also emphasize the importance of a good word list.
- d. Help the group devise ways of learning the words together (skits, games, and so on).

22. One of your students, Xiaomei, has always been made fun of and laughed at by her classmates. She is an extremely quiet child and usually by herself. Her previous teachers tried to help her, but they all found it very difficult to have other students accept her. What would you do now, as Xiaomei's teacher?

- a. Urge Xiaomei to communicate with her classmates, and praise her more in order to encourage her to take the initiative to make friends.
- b. Take the initiative to talk to her and emphasize that making friends will make her happier.

- c. Invite her to talk about her relationships with classmates. Wait until she is ready, and then encourage her to slowly loosen up and make friends.
- d. Encourage her to pay attention to how other students get along with each other and try participating in such activities herself.

23. During the past couple of weeks, things on the teacher's desk and lunch money on student desks have been disappearing mystically. Today, a teacher saw Xiaoming Ma taking a silver paperweight from her desk, so she called Xiaoming's mother. Although she suspected that Xiaoming had been involved in the other thefts as well, she only mentioned the paperweight one. She also promised Xiaoming's mother that she would keep a close eye on him. How should Xiaoming's mother handle this situation?

- a. Discuss the consequences for theft with Xiaoming, and guide him to understand how such behavior would affect his classmates.
- b. Discuss the incident with Xiaoming, express her confidence in him, and try to understand why he did it.
- c. Give Xiaoming a harsh reprimand: Stealing is not tolerable, and he must learn a lesson.
- d. Emphasize that such behavior is wrong and he needs to apologize to the teacher and promise not to do it anymore.

24. Your child has just average academic achievement, and you would like to see more progress. How would you try to make it happen?

- a. Encourage her to talk about her report card and what it means for her.
- b. Go through the report card with her, and point out where she stands in the class.
- c. Stress that she must do a better job, or she will never be able to go to college.
- d. Offer her 10 yuan for every A and 5 yuan for every B on future report cards.

APPENDIX E: Science Teacher Interview Questions

Interviewer: Thank you (name of interviewee), for agreeing to talk with me about your work as a middle school science teacher. I am interested in discussing the amount of autonomy that you have in your job. When I use the word autonomy, I am referring to the amount of independence or freedom you have to make choices regarding your teaching. I will be recording our conversation so that it can be transcribed later. All of your responses will be kept confidential. (For interviews that have a translator, the researcher will introduce the translator to the interviewee. The researcher will encourage the translator and the interviewee to ask if a question or answer needs to be repeated or further explained.)

Background Information

1. Age:
2. Gender: Male Female
3. Race/Ethnicity:
4. Do you consider yourself a native of the country in which you are currently teaching?
If no, of what country are you a native?
5. Certification/Licensure:
6. What is the age range of the students that you teach?
7. How many years of teaching experience do you have?
8. Do you have any advanced degrees beyond the bachelor's level?
If yes, please list those:
9. How many computers do students have access to in your classroom?
How many computers do students have access to in your school?
10. Which category best describes the community in which you teach:
Urban (1,000 people/square mile or 386 people/square kilometer)
Suburban (500 people/square mile or 193 people/square kilometer)
Rural (less than 500 people/square mile or less than 193 people/square kilometer)

Interview Questions

11. When you think of all of the different tasks you have as a teacher, including planning, instruction, evaluation, and other tasks, over which areas do you think you have the most autonomy? Explain.
12. How does autonomy (or the lack thereof) affect your teaching?

13. When planning a science lesson, what constraints do you have to consider concerning
 - a. colleagues?
 - b. administrators?
 - c. school curriculum?
 - d. parents?
 - e. students?

14. If you were planning to teach a science lab, what constraints do you have to consider concerning access to materials, lab space, time, or other factors in regard to
 - a. colleagues?
 - b. administrators?
 - c. school curriculum?
 - d. parents?
 - e. students?

15. a. How important do you think teacher autonomy is to the quality of instruction provided by science teachers?

b. How important is teacher autonomy to motivating science teachers to do their best?

16. a. How often do your students get to choose the topic about which they will learn?

b. How often do your students get to choose how they are going to learn about a topic?

17. Please give examples of any areas where students have choice in your classroom.

18. a. How important do you think autonomy is to student learning in science?

b. How important do you think autonomy is to student motivation in science?

19. Overall, are you satisfied with the amount of autonomy you have over your teaching? Why or why not?

20. During your teaching career, have you experienced changes in the amount of autonomy you have over teaching? Explain.

21. a. If you could design your ideal teaching situation, what would it be?

b. What prevents your from having that teaching situation?

Interviewer: Thank you for taking the time to discuss your work as a middle school science teacher with me.

APPENDIX F: Chinese Science Teacher Interview Questions (English Translation
Located in Appendix G)

科学教师采访问题

感谢您同意参与我们的调查，分享您中学科学教师的工作经验。我希望了解一些您工作中的自主性多寡的问题。自主性是指关于您所拥有的在教学中自由独立做决定的权力的大小。您的所有回答都将被严格保密。

您对这次采访的参与是自愿性质的并且您的所有答案都将被严格保密。参与这项研究您应该没有任何风险。您可以在您选择的任何地方完成这次采访（家里，咖啡厅，等等）。您可以选择拒绝回答任何令您感觉不适的问题。您也可以在任何时候自由退出这项研究。即使您决定了参加，您也可以在任何时候毫无顾虑的退出这次研究。如果您在数据收集工作结束前退出，我们会将您的资料退回给您，或者您也可以要求将资料销毁。如果您对这次研究有任何问题，您可以通过以下邮件联系我：lerobert@ncsu.edu

诚挚的

劳拉·罗伯逊

中学科学教师，科学教育学博
士生

背景信息

1. 年龄：
2. 性别： 男 女
3. 您是生于您目前教学的省份吗？
4. 如非本省，那么您来自哪里？
5. 您持有任何有效的教师资格证吗？
6. 您拥有本科以上学历吗？

7. 如果有本科以上学历，那么您的最高学历是什么？
8. 您所教学生的年龄分布是怎样的？
9. 您有多少年的教龄？
10. 您的教室中有多少台电脑供学生使用？
11. 您的学校有多少台电脑供学生使用？
12. 您会把您的学校所在位置分类为：

 城市

 郊区

 农村
13. 您在政府运营的公立学校教学吗？

采访问题

14. 在您作为老师的不同工作任务中，包括备课，教学，评估等，您认为哪一项您最具有自主性（独立或者自由）？请解释您的答案

15. 自主性（或者缺乏自主性）是如何影响您教学的？（例如，如果您有更多的自由跟自主，您会做一些跟现在所做的不一样的事情吗？）请解释。

16. 在为科学学科备课时，您需要考虑到哪些限制约束？

a. 同事

b. 学校行政管理人员

c. 学校或有关教育部门规定的全部课程进度

d. 学生家长

e. 学生

17. 如果您打算教一门科学实验课，关于实验器材，实验室空间，时间及其他因素，您认为需要考虑哪些限制约束？

a. 同事（您跟别人共用实验室，实验器材或者设备吗？你们用相同的试卷试题吗？对于同样的实验课题，你们会以同样的顺序和速度来教学吗？）

b. 学校行政管理人员

c. 学校或教育部门规定的全部课程的进度

d. 学生家长

e. 学生

18. a. 您认为教师自主性对于科学教师教课质量的重要性如何？请解释

b. 您认为自主性对于激发科学教师力图做到最好的重要性如何？请解释

c. 激发您力图做到最好的因素是什么？

d. 您多久修改一次教学计划以满足个别同学或者部分（小部分或大多）同学需求？

19. a. 您的学生可以选择将要学习的知识的课题吗？如果可以，他们多久选择一次？请解释

b.
您的学生可以选择将要学习知识的学习方法吗？如果可以，他们多久选择一次？请解释

20. 请举例说明任意您的学生在教室内拥有选择权的方面

21. a. 您认为自主性对学生学习科学的重要性如何？请解释

b. 您认为自主性对学生学习科学知识积极性的**重要性**如何？请解释

22. 总体来讲，您对您教学中所拥有的自主性的**程度**多寡满意吗？为什么？

23. 在您的教学生涯中，您经历过所拥有的自主性多寡的**改变**吗？请解释

24. a. 如果您可以决定您的理想教学环境，它将是什么样子的？

b. 您最理想的课堂大小是多大（一个班级中有多少学生）？

c. 阻止您拥有您理想教学环境的因素是什么？

非常感谢您作为一个中学科学教师能百忙中抽出时间分享探讨您的工作。

APPENDIX G: English Translation of Chinese Science Teacher Interview Questions

Thank you for agreeing to share about your work as a middle school science teacher. I am interested in the amount of autonomy that you have in your job. By autonomy, I am referring to the amount of independence or freedom you have to make choices regarding your teaching. All of your responses will be kept confidential.

Your participation in this interview is voluntary and your responses will be kept confidential. There should be no risks to you from this research. You may complete the interview questions at the location of your choice (home, coffee shop, etc.). You may choose not to answer any questions that make you uncomfortable. You are free to withdraw from the study at any time. If you decide to participate, you may withdraw from the study at any time without penalty. If you withdraw from the study before data collection is completed your data will be returned to you or destroyed at your request. If you have questions about the study, you may contact me at any time through email at lerobert@ncsu.edu

Sincerely,

Laura Robertson
Middle School Science Teacher and
Doctoral Student
Science Education

Background Information

1. Age:
2. Gender: Male Female
3. Were you born in the province in which you are currently teaching?
4. If you answered “no” for the last question, where are you from?
5. Do you hold a current teaching certificate or licensure?
6. Do you have a degree above the Bachelor’s level?
7. If you answered “yes” for the last question, what is your highest degree?
8. What are the ages of the students that you teach?
9. How many years of teaching experience do you have?
10. How many computers do students have access to in your classroom?
11. How many computers do students have access to in your school?

12. Which category best describes the community in which you teach:
Urban
Suburban
Rural

13. Do you teach in a public school run by the government?

Interview Questions

14. When you think of all of the different tasks you have as a teacher, including planning, instruction, evaluation, and other tasks, over which areas do you think you have the most autonomy (independence or freedom)? Please explain your answer.
15. How does autonomy (or the lack thereof) affect your teaching? (For example, would you do things differently if you had more freedom or independence?) Please explain.
16. When planning a science lesson, what constraints do you have to consider concerning
- colleagues?
 - administrators?
 - school curriculum or education standards?
 - parents?
 - students?
17. If you were planning to teach a science lab, what constraints do you have to consider concerning access to materials, lab space, time, or other factors in regard to
- colleagues? (Do you share lab space, materials, or equipment? Do you use the same tests? Do you cover topics in the same order and at the same pace?)
 - administrators?
 - school curriculum or education standards?
 - parents?
 - students?

18. a. How important do you think teacher autonomy is to the quality of instruction provided by science teachers? Please explain.
 - b. How important is teacher autonomy to motivating science teachers to do their best? Please explain.
 - c. What motivates you to do your best as a teacher?
 - d. How often do you modify your teaching plans to meet the needs of individual students or groups of students within a class? Please explain.
19. a. Do your students get to choose the topic that they will study? If yes, how often? Please explain.
 - b. Do your students get to choose how they are going to learn about a topic? If yes, how often? Please explain.
20. Please give examples of any areas where students have choice in your classroom.
21. a. How important do you think autonomy is to student learning in science? Please explain.
 - b. How important do you think autonomy is to student motivation in science? Please explain.
22. Overall, are you satisfied with the amount of autonomy you have in your teaching? Why or why not?
23. During your teaching career, have you experienced changes in the amount of autonomy you have over teaching? Explain.
24. a. If you could design your ideal teaching situation, what would it be?
 - b. What would be your ideal class size?
 - c. What prevents you from having that teaching situation?

Thank you for taking the time to discuss your work as a middle school science teacher.

APPENDIX H: United States Teacher Interview Sample Transcript

Background Information

1. Age: I'm 34 now. I was 33 when I did the survey.
2. Gender: female
3. Race/Ethnicity: Caucasian
4. Do you consider yourself a native of the country in which you are currently teaching? Yes
5. Certification/Licensure: k-6 elementary education
6. What is the age range of the students that you teach? 11-12
7. How many years of teaching experience do you have? 12
8. Do you have any advanced degrees beyond the bachelor's level? No, National boards
If yes, please list those:
9. How many computers do students have access to in your classroom? 2
How many computers do students have access to in your school? 80
10. Which category best describes the community in which you teach:
Suburban
11. Public

Interview Questions

12. When you think of all of the different tasks you have as a teacher, including planning, instruction, evaluation, and other tasks, over which areas do you think you have the most autonomy? Explain.

I would say lesson planning. Just because, science is not –we don't have an official end-of-grade test that's given by the district. I think that there's a lot less, you know, pressure to have to, you know, have things a certain way. So I think you're more free to, you know, do activities that you want to. You don't feel like you always have to do certain activities. While I think since Language Arts and math are tested, I think they have a lot less autonomy than we do.

13. How does autonomy (or the lack thereof) affect your teaching?

I think, you know, it allows me to do other activities –that I don't have a list of activities that I have to do. I can try new things. And, hopefully, motivate my students by doing that.

(So there's not a lot of administrative pressure either?)

There is as far as we're expected to have high level, rigorous lessons. So in that sense, you know, there's pressure there. We're expected to differentiate for those lower-performing students as we should for the higher-performing. So there's those sorts of pressures. But I don't feel like there's a set of activities that they expect me to do. You know, I think that –I think they're OK with me trying new things as long as my students are learning and they're under control and it's a rigorous activity.

14. When planning a science lesson, what constraints do you have to consider concerning

f. colleagues?

Let's see...I guess...mainly how am I held back?

(Yes, perhaps if you have any common assessments that you're expected to do, or, you know, if they have any expectations for all sixth grade teachers, or anything like that.)

They expect as far as science –I teach on a team with two other science teachers whom I plan with. But we all are expected to give the same, common assessments, which we design together. So, we work together on the assessments, so I don't necessarily feel as if I'm giving somebody else's test. I mean, we created it together.

(And, so do you all kind of have to stay on the same schedule during the year?)

Yes. We plan together once a week for an hour. And we're on an A day, B day schedule, so we teach three 90-minute blocks of science on A days and then three more 90-minute blocks on B day. So we're able to plan several lessons within that hour. And then we pretty much do close to the same thing each day. Our personalities are different, you know, so it's not word-for-word the same thing. But we try to do the same activities each day.

g. administrators?

h. school curriculum?

Well, like this year, we're starting to implement professional learning communities. And so we go about planning differently. At the end of a planning session we're expected to fill out questions. They're called our planning minutes. We have to fill out questions like, "What do we want the students to learn?" and how we're going to teach it to them. Something like, "In the past, what has worked and what didn't?" Or, "In past lessons, what has worked? What didn't?" And reflect on them, and, hopefully, change whatever it was about that lesson that wasn't good and fix it in the future. And then, another question is, "What are you going to do for those students who don't learn the material? How are you going to assess the students if they learned it? What are you going to do for those who don't learn it?" So were basically supposed to answer those questions at the end of each planning session. And that's a school-wide thing.

i. parents?

Yes, I know if their child has an IEP or something like that, I mean, the parents are very involved to expect the materials are differentiated for their child. So in that sense, that expectation is there. But that's also there from the administration. But for the most part, I don't feel like parents do. I mean, at the beginning of the year, they're a little bit hesitant that their sixth grader is going to be doing science labs and things like that. I think that some of them are a little bit panicked about what that's going to do. But, you know, I don't really feel like they put restraints on what I'm doing.

j. students?

Yes. Within the last couple of years, I've had a fair amount of—I've had a much larger population of lower-performing students. So I've definitely had to change the way that I do things in the last couple of years.

15. If you were planning to teach a science lab, what constraints do you have to consider concerning access to materials, lab space, time, or other factors in regard to

k. colleagues?

l. administrators?

m. school curriculum?

n. parents?

o. students?

We have a lot of equipment and things like that. Probably the only constraints would be the activities that I want to do have a lot of consumable materials that I can't buy ahead of time and keep in my classroom. And there's really no extra money for that. That would be one way that I'm limited. Sometimes I see labs that I want to do, but by the time I would buy all of the materials, and I have 165 students, by the time I would have enough stuff for all of them, it would just be too expensive.

(Oh, my. You have a 165 students?)

Yes. Yes.

(How big are your classes?)

Um, they're anywhere from like 25 to 30. I have six classes.

(Oh my gosh. That is shocking. I teach middle school science. I teach 7th and 8th grade. I'm at a very small school. I see 100 students a day. That's four, twenty-five student classes. And I get overwhelmed with that. I just think, "How am I supposed to monitor the learning of 100 kids?" I can't believe you have 165.)

Yeah, it takes me until about this time in the year to get a really good understanding of how well I know them –you know, as far as their abilities. I only see them every other day. You know, so I feel like the math and Language Arts teachers get to know them a lot better and quicker than I do.

(So, do you have a lab or do you do all of your activities in your classroom?)

My classroom is a science lab, so I've got seven sinks in my classroom. And I've got lab tables. And I'm fortunate to have a lot of equipment. The school here opened in 2002, so I've been here since it opened. Which is nice, because we've been able to order a lot of stuff that we needed. We tried to build it up each year. But mainly it's the cost of getting all of the consumables that, you know, being able to get all of that.

(Does your classroom have lab space and desk space?)

The students sit at lab tables and then around the edges of the room are lab counters where the sinks are. And there are stools over there that slide under the counter also. So they can do the lab at their table, or sometimes they do it over at the counter. It's definitely nice. And if we have need hot plates, or something like that that needs to be plugged in, then I'll have them do the lab at the counter.

16. a. How important do you think teacher autonomy is to the quality of instruction provided by science teachers?

I think it's really important, because I think having the freedom to do a variety of different activities, then you're really able to meet the needs of your students. If you're doing a certain activity and you realize that it doesn't reach them, then you can always feel like you can change it and try something new and, you know, motivate your students. Because if you're not able to motivate them and you're not able to reach them, then they're not going to learn anything. I think constantly trying to change the way that you do things if it's not working. If you don't have autonomy and you're always told to do things a certain way, I think you can really lose your students because they're just not motivated.

- b. How important is teacher autonomy to motivating science teachers to do their best?

I think it's really important. I think if people feel that they are confined and have to do things a certain way all the time, that they're not able to, you know, do their best as a teacher. And I think, you know, in that same sense with the students, if the teachers are not going to be motivated then if they don't have opportunities to try new things in the classroom and feel like they can make choices that are best for their students.

17. a. How often do your students get to choose the topic about which they will learn?

Hmm. They probably never really choose the topic that they're going to learn about just because, you know, you have a certain curriculum. But I try to expose them to inquiry lessons so they're able to design their own experiment to try and answer a specific question. So, I guess, in that sense they get to choose the experiment as far as, like, the topic that they're learning about., usually I give them that.

b. How often do your students get to choose how they are going to learn about a topic?

Umm, sometimes I'll ask them, you know, I'll take a vote. And I'll say, "What activity did we do that helped you understand this the best?" So, I kind of have them vote in that way. I get an idea of this activity that we did helped them understand the most, so that's something that I'm going to keep doing. And they're usually pretty honest about that. We'll try and do things like that where maybe at the end of a unit we'll talk about certain different things that we did. And I'll say, "What helped you understand the most?" Is that what you're asking about?

(Yes. Yes.)

18. Please give examples of any areas where students have choice in your classroom.

Yeah, like sometimes I'll try and have stations. So I'll set up –I have eight groups, eight groups of four in my classroom. And I'll set up –well I have seven groups most of the time – one class I have eight groups. So I'll set up some stations and they can choose where they're going to go in the classroom. So, like, if they finish a particular station, I'll have extra copies or extra stations set up so they can go and just move on to the next one at their own pace. If they're in a group of four, and two of them finish but the other two are still working, then I'll tell them, "If you're done, go ahead and get up and go to another station and get started." So they have a choice as far as the pace that they're going to work at and what station they want to do next.

19. a. How important do you think autonomy is to student learning in science?

I think it's really important. I mean, if they feel like they are being told what to do all the time, I don't think they're going to like it. And I notice when kids do inquiry labs, kids that are not usually overly motivated in school, tend to be more motivated during inquiry labs. I think they feel like they have –because we talk about what real scientists do. And I tell them that scientists are not right all the time. They don't come up with the right answer all the time. And it's OK to be wrong. So I think those lower performing students that normally don't see a lot of success sometimes, feel success in that activity. Because they know that it's OK if they end up being wrong. You know, it's not going to count against them as long as they're able to reflect on why their answer didn't come out the way that they thought it was going to. Then it's still OK. But I think giving them the choice –especially in middle school. In elementary school I don't think they're given as many choices. And now I think a lot of them really start to rise to the occasion and do enjoy being given more choices as far as what activities they like to do and giving suggestions about what they enjoy. I think that is something that definitely keeps them motivated. And they feel like their opinion counts then and that's important to them.

b. How important do you think autonomy is to student motivation in science?

I think that because they're motivated, they're, you know, trying to do their best. And I think that being able to reflect on the different activities that they've done, you know, I think that really does affect their learning. You know, when they do an inquiry lab and they have to

explain why their results turned out the way that they did, that's definitely high level learning—having to explain what their results were or the way that they did it.

20. Overall, are you satisfied with the amount of autonomy you have over your teaching? Why or why not?

Yes, I would say that I am. I think that as far as the way the curriculum lends itself and the way that it's set up, I think that that could be a little bit different. And I think that would even help the autonomy even more. But, yeah, I definitely don't feel like—you know, I feel like I can do activities in my classroom that are my choice. And I don't feel like I'm restricted from doing them.

21. During your teaching career, have you experienced changes in the amount of autonomy you have over teaching? Explain.

Yes, I think more so—I think as you've been teaching longer, I think people begin to, like administrators, I think they begin to trust that you know what you're doing more so than when you're a new teacher. So I think if your teaching for awhile and proving that you know what you're doing, that that autonomy lends itself more.

(Have you taught in different schools?)

Yes, this is my third school that I've been in. My first school was in more of a rural area and mainly had students from low socioeconomic [status]. And then I was only at that school for a year. And then I moved to a different school and then I moved with that principal to the school that I'm at right now. So basically the last ten years I've worked with a lot of the same people and in the same suburban community even though it's been two different schools. That first year was very different from what I have now.

(But not in terms of autonomy that much?)

Well, that first year I taught math. And I really didn't feel then that I was restricted as far as what I was doing. I was pretty much just handed the textbook and told, "Just go for it." So I didn't really have a lot of restrictions then.

22. a. If you could design your ideal teaching situation, what would it be?

I would say in my ideal situation I would have a computer in my classroom for every student and that they'd have access to it everyday. Because I think now there's so many things on the computer that I would love to have them do. You know, everyone is trying to sign up for the computer lab and it's just so hard, because I teach six classes. I would need to book the computer lab back to back. And it's really hard to get those time slots. So even though we have a computer lab, it's really hard to get all six of my classes in there when I need them to be in there. So that would probably be the ideal situation for each kid to have a computer and to have money available so I can buy consumables for my classroom that I needed when I needed them.

(What would your ideal class size be?)

Oh wow. I'd say it would kind of depend on what type of students. If they're heterogeneously grouped, then, you know, the smaller, maybe like 15. But, you know, if you had a group of very high performing students, I think you could easily still have 20 to 25 and be OK. Because they don't need as much of that individualized instruction like the lower performing. I think it really depends on how they're grouped. It be 10 to 15, 15 at the most if you had heterogeneous groups. Like, even now in one of my classes, I think there's 25 kids in there of all different ability levels. And I think if I had less kids in there I would be able to give so much more individualized time to those that needed it. But I, you know, it's just too hard to do all the time.

b. What prevents your from having that teaching situation?

Having the lower class numbers like that?

(Yeah, that and the computers and all of that.)

Basically just money. You know, I'm working with a Smart Board in my classroom. So I'm very lucky in that sense. But it's just money-wise. Like, I know a lot of the teacher computers at the school, they came when the school opened. So they're starting to die. I know they are trying in the district to get new computers to replace those even teacher computers. It's mainly with budget cuts recently that we haven't—that it's just not possible right now.

(So what factors would you say motivate you the most in your teaching? What motivates you to teach and do a good job?)

I think it's just seeing the kids excited about certain things. You know, I try to change things a lot and I try not to do the same stuff all the time. Seeing them excited about what they're doing makes me excited about what I'm doing. I guess it's their reaction to certain things that we do in class. If they're excited, then it makes me excited about what we're doing.

(Well, is there anything related to autonomy or motivation that I haven't asked that you would like to add?)

I guess, you know, I just think it's so good for kids to have teachers that feel they have the ability to make decisions within their own classrooms. And I think with us going for this whole testing mentality all the time, no matter what they call it, they should never teach to the test. And I feel like now, not so much with courses that are not end-of-grade tested, but I feel like that's what ends up happening. And it's sad that that happens. You know, I just feel like if teachers feel like they have autonomy in their classroom, I think it just makes for a better teacher. Because they feel like they're given respect to make decisions that they feel are best for their students in the classroom.

(Well, thank very much for your time. I really, really appreciate it.)

Oh, you're welcome. I hope I gave the answers that you needed.

(Oh, absolutely. It's been really interesting and nice to talk with teachers doing this. And I will remember your 165 students the next time I start to feel frustrated. That blows my mind.)

Well, grading papers is quite a nightmare.

(Yeah, I'm sure.)

Yeah, it would be great if we could all just have a classroom of 20. Then we could learn about them real fast.

(I know. I was thinking while you were talking, how do you even learn 165 names at the beginning of the year?)

Oh, I know. It takes forever. I tell them to be patient with me. That I really am trying to learn them.

(Well, thanks again. I will send you an Amazon giftcard through your email.)

Great. Thank you so much.

(Well, thank you and good luck with the rest of your school year.)

Thanks. Same to you.

Interviewer: Thank you for taking the time to discuss your work as a middle school science teacher with me.