

Applying Self-authorship Theory among Chinese Engineering Doctoral Students in U.S. Institutions

Dr. Jiabin Zhu, Shanghai Jiao Tong University

Jiabin Zhu, Ph.D., is an Assistant Professor at the Graduate School of Education in Shanghai Jiao Tong University, P. R. China. She obtained a B.S. in Physics from East China Normal University, a M.S. in Optics from Chinese Academy of Sciences, a second M.S. in Biomedical Engineering and a Ph.D. in Engineering Education from Purdue University. Her primary research interests relate to the development of engineering students' professional skills, the assessment of teaching and learning in engineering, and the cognitive development of graduate and undergraduate students.

Miss Qunqun Liu

Qunqun Liu is a graduate student in the Graduate School of Education at Shanghai Jiaotong University. She obtained a B.S. in public administration from China Agricultural University. Her current interest focuses on the cognitive development of engineering graduate students.

Dr. Monica Farmer Cox, Purdue University, West Lafayette

Monica F. Cox, Ph.D. is an Associate Professor in the School of Engineering Education and is the Inaugural Director of the College of Engineering's Leadership Minor at Purdue University. She also serves as the Executive Director of the International Institute for Engineering Education Assessment (i2e2a). She obtained a B.S. in mathematics from Spelman College, a M.S. in industrial engineering from the University of Alabama, and a Ph.D. in Leadership and Policy Studies from Peabody College of Vanderbilt University. Her teaching interests relate to the professional development of graduate engineering students and to leadership, policy, and change in STEM education. Primary research projects explore the preparation of graduate students for diverse careers and the development of reliable and valid engineering education assessment tools. She is a NSF Faculty Early Career (CAREER) and Presidential Early Career Award for Scientists and Engineers (PECASE) recipient.

Applying Self-authorship Theory among Chinese Engineering Doctoral Students in U.S. Institutions

Abstract

Despite a large representation of Chinese students in U.S. engineering doctoral programs, these students are understudied compared to their U.S.-born peers. In this study, we applied self-authorship theory among Chinese engineering doctoral students in U.S. institutions. Using this theory, we try to understand the Chinese engineering doctoral students' development towards self-authorship. Focusing on sixteen participants who had been identified to exhibit self-authorship in the *epistemological dimension* through prior research, we explored students' development in the other two dimensions of self-authorship theory, i.e. the *intrapersonal* and *interpersonal dimensions*. Our preliminary results based on qualitative data suggest that these students have also demonstrated progress towards self-authorship in these two dimensions. The demonstrations of their development in these two dimensions are closely related to their development in the *epistemological dimension*. Specific examples of students' demonstrations of self-authorship in all three dimensions are provided. Future work includes exploring factors that can contribute to students' development towards self-authorship.

Introduction

Many international talents flow to the U.S. to pursue academic degrees each year. Among these students, Chinese students rank top in the number of doctorate recipients in science and engineering fields with a total of 32,973 students graduated with science or engineering doctorate degrees from U.S. institutions between 1999 and 2009¹. Despite the prominent representation of international students, including Chinese students, among the science and engineering doctoral students in U.S. institutions, however, these scientists and engineers are understudied compared to their U.S.-born peers².

Among current qualitative and quantitative research findings on foreign-born talents including Chinese students and scholars in U.S. institutions, most efforts focused on their academic performance, or adjustment issues, such as language barriers, the sense of isolation, lack of collegiality²⁻⁵. These studies offered useful information about different aspects of said students' learning outcomes, experiences or their perceptions of their learning experiences. Nevertheless, few efforts were made to understand their lived learning experiences in U.S. institutions from an integrated or holistic perspective.

Self-authorship theory represents an integrated perspective that examines an individual's development towards self-authorship in three dimensions, that is, the *epistemological*, *intrapersonal*, and *interpersonal dimensions*⁶⁻⁷. Self-authorship theory was built upon over four decades of prior research within the field of epistemological developmental studies⁸⁻¹². In this study, we try to understand Chinese engineering doctoral students' learning experiences in U.S. institutions through the perspective of self-authorship theory. Through an in-depth understanding of said students' learning experiences, including their research experiences, course learning experiences, and interactions with advisors/ professors/peers etc., we aim to understand said students' cognitive and psychosocial development from a holistic perspective.

Theoretical Framework

Self-authorship theory was developed based upon a twenty-year longitudinal study following 101 participants from their college freshman years in 1986 up to their later adult years⁶. This theory was also built upon previous understanding on young adults' epistemological development⁸⁻¹² and theories on the role of self and relationship¹³. Self-authorship theory depicts young adults' development towards self-authorship in three dimensions, i.e. the *epistemological*, *intrapersonal*, and *interpersonal* dimensions⁶. For an individual, the development towards self-authorship involves an essential growth in epistemological thinking, with a concurrent growth in one's personal identity and relationship to others⁷. The development towards self-authorship is depicted in Figure 1.

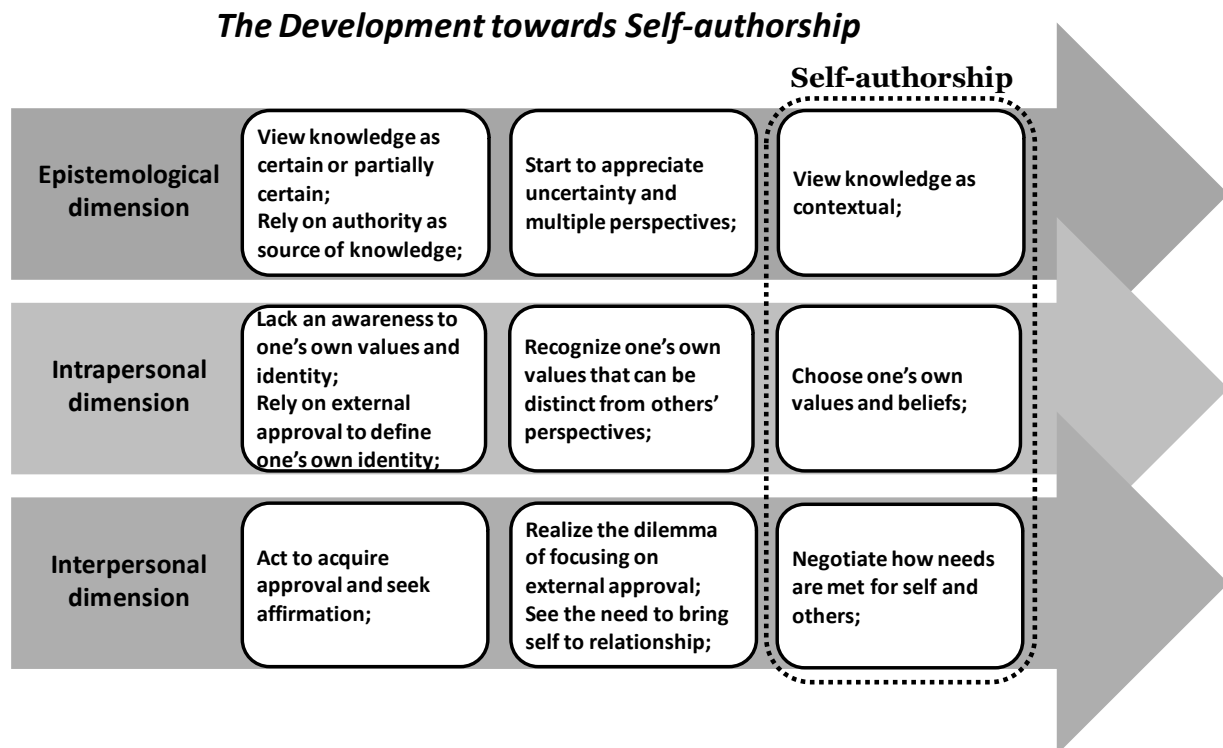


Figure 1. The development towards self-authorship (Modified from references 6 and 7)

In the *epistemological dimension*, an individual gradually moves from a dualistic way of knowing to a contextual and evaluative manner of knowing. This development replicates the trend depicted in prior theories, such as Perry's theory⁸. Perry's theory describes students' epistemological development in four different stages, that is, *Dualism*, *Multiplicity*, *Relativism* and *Commitment in Relativism*⁸. These four stages depict one's development from thinking in a dualistic manner to a relativistic manner. Students who progress onto the latter two stages have demonstrated a relativistic way of thinking and started to adopt this way of thinking in different areas of life. This developmental trend was repeatedly confirmed by its following theories and frameworks⁹⁻¹². Self-authorship theory incorporated valid findings from prior epistemological theories into the *epistemological dimension* of the theory⁶⁻⁷.

In addition, self-authorship theory also included another two dimensions, i.e. the *intrapersonal* and *interpersonal* dimensions. In the *intrapersonal dimension*, one develops from relying on an

external authority to relying on one's own values and beliefs. In the *interpersonal dimension*, one changes from trying to acquire external approval to better relating to others through a process of mutual negotiations. The incorporation of these two dimensions allows self-authorship theory to capture one's development in both the psychosocial and the cognitive aspects.

As an integrated framework for student development, self-authorship theory offers a useful holistic perspective to understand different aspects of students' experiences and perceptions. In this study, we attempt to understand Chinese engineering doctoral students' development towards self-authorship.

Literature Review

The U.S. graduate program draws thousands of international students each year from different countries, including China. According to the statistics by the National Science Foundation, nearly 30,000 Chinese doctoral students were enrolled in U.S. graduate programs in science and engineering fields in fall 2009¹⁴. The enrollment number for Chinese students was higher than any other foreign countries in the U.S. science and engineering doctoral programs. Despite the large representation of these students in science and engineering, few current studies have focused on these students' cognitive and psychosocial development through an integrated perspective. In contrast, studies on their U.S.-born peers using related theories, including self-authorship theory, have evolved over the past four decades⁸⁻¹². Students' development towards self-authorship, especially in the epistemological dimension, i.e. the development of a relativistic way of knowing, has attracted great interest among researchers and educators including those from the field of engineering education¹⁵⁻¹⁷.

As to engineering students' epistemological development, prior findings showed that only a quarter of undergraduate students had attained a relativistic way of thinking by graduation¹⁵. Among the multiple efforts to promote students' epistemological development, researchers suggested that active participation in the engineering curriculum with experiential components, such as solving open-ended real-world projects, would substantially help engineering students develop sophisticated thinking¹⁵.

The U.S. engineering graduate program highlights the development of students' independent research skills, analytical thinking skills, teamwork skills, problem-solving skills etc. The enhancement of said skills ties closely to students' development of relativistic thinking and an in-depth understanding of self and relationship to others⁷. For graduate students, Baxter Magolda showed that they tend to demonstrate more complex thinking than undergraduate students¹⁸. Our recent study focusing on Chinese engineering doctoral students suggested that nearly 80% of the sampled students have demonstrated relativistic or contextual way of thinking in the context of Perry's theory¹⁹.

Despite current research about students' development in the *epistemological dimension*, what is lacking in the literature, however, concerns students' development in the *intrapersonal* and *interpersonal dimensions*. In this current study, we try to explore students' development towards self-authorship from an integrated perspective. Specifically, we focus on students who have showed self-authorship in the *epistemological dimension* through our prior research. In this current report, our research questions are,

1. For students who have showed self-authorship in the *epistemological dimension*, what are their developments towards self-authorship, if any, in the *intrapersonal dimension*?

2. For students who have showed self-authorship in the *epistemological dimension*, what are their developments towards self-authorship, if any, in the *interpersonal dimension*?

Prior Study

In our prior study among Chinese engineering doctoral students, one hundred and forty-seven students' epistemological developmental profiles were mapped in the context of Perry's theory through a quantitative measurement¹⁹. Around 80% of the participants were found to show *Relativism* and/or *Commitment in Relativism* as their prominent way of thinking. Interviews were followed to further understand their learning experiences, such as their research experiences, course learning experiences, their interactions with advisors/professors/peers, etc. Our current study was based on these follow-up interviews using self-authorship theory as our theoretical perspective. Focusing on the students who have already shown development towards self-authorship in the *epistemological dimension*, i.e. a relativistic way of thinking, we examined the students' development towards self-authorship in the *intrapersonal* and *interpersonal dimensions*.

Methods

Data Collection

In our prior research, Chinese doctoral students in engineering programs were recruited from five Midwestern universities. These students responded to a quantitative survey that was in the context of Perry's theory¹⁹. Among the 147 complete responses, nineteen students agreed to be interviewed in a one-on-one manner. Among the interview participants, sixteen students' prominent epistemological thinking styles were identified as *Relativism* and/or *Commitment in Relativism* through our survey results. This means that these sixteen students have already demonstrated a contextual or relativistic way of thinking, or, self-authorship, in the *epistemological dimension*. These sixteen students constituted our sample for this current study. The information about their prominent epistemological thinking styles, pseudonyms, genders and ages was displayed in Table 1.

Table 1 Basic information about the interview participants

Epistemological Thinking	Pseudonym	Gender	Age
Relativism	Rick	M	22-25
Relativism	Robert	M	22-25
Relativism	Ron	M	22-25
Relativism	Rena	F	25-30
Relativism	Ryan	M	25-30
Relativism	Ruby	F	25-30
Relativism	Rose	F	22-25
Relativism	Rebekah	F	25-30
Relativism	Ray	M	25-30
Relativism -Commitment	Ken	M	22-25
Relativism -Commitment	Kirk	M	25-30
Relativism -Commitment	Kevin	M	30-35
Commitment	Cameron	M	22-25
Commitment	Cody	M	25-30
Commitment	Charles	M	<22
Commitment	Charlie	M	25-30

Interview questions were modified from Baxter Magolda's prior interview protocol¹¹. Interview questions were asked to introduce different topics, such as role of learners, role of advisors/professors, etc. The advantage of this protocol was that it provided a scope of topic without framing the response. Sample questions are shown as follows:

-Now, think about yourself as a learner in the classroom, in a research group, or in a project team. What role do you play, what method do you use, to make learning more effective for you?

-As you think about your instructors, professors, advisor(s), what role do you think they have played that made you learn effectively?

Data Analysis

All sixteen interviews were transcribed. After the transcription, transcripts were revised where all potential identifiers were substituted with acronyms to protect the students' identities. Qualitative data analysis was performed to extract the themes and trends of our data. A brief description of qualitative data analysis procedures is described as follows.

Prior to data analysis, all qualitative data were read and re-read to make a general sense. Researcher kept reflective notes throughout the reading process. Self-authorship theory was used as the theoretical framework to guide the data analysis process²⁰. Three first-level codes were pre-defined as *Epistemological Dimension*, *Intrapersonal Dimension* and *Interpersonal Dimension*. Within the framing of these three first-level codes, open coding procedure was then performed throughout the transcripts to identify second-level codes²¹.

Preliminary Results

Using the self-authorship theory as the guiding framework, we organized our findings in the three dimensions of self-authorship theory. Our findings from qualitative data analysis confirmed students' development towards self-authorship in the *epistemological dimension*. The students

not only started to appreciate multiple perspectives, they also actively sought to test knowledge using multiple resources and evaluate evidences. In the *intrapersonal dimension*, recognizing the limitations of their advisors/professors' ideas, the students started to explore their research scopes/topics/projects in an independent manner. In this process of conducting independent research, they also gradually developed their own values and philosophies with regards to research. Corresponding to this trend, they tried to think, learn, and solve problems in an independent manner. The feature of being independent and choosing one's own values and beliefs was also reflected in their choices of personal goals, career paths and life styles. In the *interpersonal dimension*, most students acknowledged advisors/professors' role as a guide only. With an awareness of shared authority between the advisors/professors and the students, the students have realized the need to bring self to relationship. They started to learn to resolve conflicts, sometimes even conflicts with their advisors, in a rational way.

Epistemological Dimension

The participants were identified to have demonstrated relativistic thinking through our prior research¹⁹. Our qualitative analysis confirmed students' development toward self-authorship in the *epistemological dimension*. That is, students actively sought out information from multiple resources (e.g. literature, books, websites, talking to different people, etc.) to gain a broad view of topics/projects/questions. Here is what Kirk says about his experiences with group projects,

“Everyone thinks differently, for the same problem, maybe, your perspectives can be different. So, it helps you to view a problem differently, right. ... Many American students, they experienced education in an American style, and for us, from China, (we got) the Chinese education, it's different. Therefore, it's different when we are trying to solve a problem. Therefore, in this sense, it helps you to open, um, to have a broader view, to see from a different angle. There are different ways to solve a problem, now you can solve the problem from different angles.”

Along with the appreciation of multiple perspectives, students also actively test knowledge and opinions. As an example, here is what Ryan described his reactions towards his advisor's suggestions,

“For the disadvantages, first, you will definitely need to test, whether the disadvantage he (the advisor) points out is really a disadvantage or not. Right, this, because what he says may not be correct. It's just his thought. Therefore, you need to test this thing.”

To summarize, students appreciated multiple perspectives and started to view knowledge as contextual by the evaluation of different views and perspectives. Considering their development towards self-authorship in the *epistemological dimension*, it is interesting to explore their development on the other two dimensions.

Intrapersonal Dimension

Realizing advisors/professors' limitations, most students started to develop their own ideas and values in different areas, such as research, course learning and other aspects of life. The development of students in the *intrapersonal dimension* was characterized by students' choosing their own ideas and values in different areas of life. Here is what Kirk said about his experiences,

“The ability to think independently...this ability is very important especially in the academia... To have your independent thoughts or skills to solve problem independently, this is important. For example, like, the boss gives you a task which you are not familiar at all. But, the boss can't give you any guidance because he doesn't know about it either. But he wants you to do it. Then, it is entirely up to you, to find what you want. There may be something you have not learned before, you need to fill the gap.”

In the process of conducting research in an independent manner, they also started to develop their values/philosophies in doing research. Ryan talked about the important role of interest for one to conduct research.

“I think to do research, interest is the most important. That's for sure. If you don't have interest, you will feel painful when doing things. Plus, you won't be devoted. You won't go very deep. Certainly for most people, it is just a tool to make a living.”

Besides conducting research in an independent manner and actively exploring ideas in research, they also started to choose their own ideas and values in other areas of life. As an example, several students mentioned their choices of religious belief, which has enabled the participants to re-consider their life goals and view different aspects of life through this lens. Rebekah described how her choice of personal belief has impacted her life:

*“My decision was, as I mentioned, about my faith (Christian faith). I think, that was, like, to break down the whole person, and change. **Your philosophy has changed. Life goals have changed. The ways to deal with things have changed. And, it becomes, like, the whole person is different. And you will like yourself more.**”*

This development of self-authorship in the *intrapersonal dimension* was characterized by students' choosing their own ideas and values in different areas, such as learning, research, personal beliefs, etc. It was accompanied by a new relationship with advisors, professors, and peers as discussed in the following section for the *interpersonal dimension*.

Interpersonal Dimension

In the *interpersonal dimension*, most of the students have acknowledged that the role of advisors/professors was only like a guide. They actively brought up their ideas and communicated with the advisors/professors. Here is what Rick said about his interactions with his advisor,

“...to do this project, usually I will try to solve the problems using my own ways. I will choose the direction that I want to go. But then, it's like, I will go and discuss with the advisor once in a while, let him decide, say, what I am doing, the direction that I want to go, whether that is a good direction or not for him. Of course he may have some different opinions. Then, we will have some debate and discussions. I mean, I will not always regard his opinions as 100% correct. I will read a lot of materials, and discern for myself to see whether his opinions or my opinions are correct.”

It seemed that he was able to resolve conflicts, even that with his advisor. Students also mentioned cases in which they tried to resolve conflicts, or to balance needs and expectations

among group members in a rational way. Here is what Rose said about her experiences with group projects,

“Um, they always had us do this kind of group projects when I was in [location]. At the beginning, I disliked it a lot. I found it troublesome, like, meetings and discussions, etc. Everyone progressed at a different pace. It is difficult to coordinate. But, later I thought that was a good exercise. That is, it is difficult to collaborate with each other. So, you need to be tolerant. Or, sometimes, you need to do more and don’t have high expectations towards others. Sometimes, other team members are better than you. So, it becomes a dynamic process, like, who is going to be the leader of the group. If you think other group members are not so good, you should, don’t complain. Instead, you can undertake more responsibilities; just try to be the leader. If there is someone better than you in the group, then try to be a follower. So I think, it is about a cooperative mode. I think being in the laboratory is the same as well. That is, you should appreciate others’ advantages and discover the strengths of others.”

In this case, Rose was able to collaborate with other group members by balancing their respective needs and skills. It seemed that our participants have developed ways to resolve conflicts so that needs are met for self and others. Ruby learned a way of expressing herself which helped her communications with her instructor,

*“Well, let me see. I think another important thing is, as I just mentioned, a direct way (for communication). Like, when I emailed the instructor, I said it directly, I hoped that he would improve my grades. Then I listed one, two, three, three evidence, well, reasons. I used three reasons to support my argument. That is, **the way you talk, very straightforward, well-supported. This way of expressing yourself, either in speaking or writing emails, or doing presentations, this way, I think, is the most important thing I learned.**”*

This direct way of expressing one’s idea, along with other manners of communications, suggested that students have started to bring their identities, values and ideas to the relationships. They have started to demonstrate the ability to be involved in authentic, interdependent relationships.

Discussion

Our preliminary results suggest that students who have developed self-authorship in the *epistemological dimension* seemed to have demonstrated some development toward self-authorship in the *intrapersonal* and *interpersonal dimensions*. Students started to show abilities to think/learn/conduct research in an independent manner. They actively chose their own ideas and beliefs. The development of self-authorship in the *intrapersonal dimension* was accompanied by a new relationship with their advisors/professors/peers. The implications of our preliminary results can be summarized as follows.

First, through the focus upon engineering doctoral students, these findings allow for an operationalization of self-authorship theory for engineering students’ diverse learning and research experiences in U.S. doctoral programs. By exploring students’ experiences in these three dimensions, it could potentially help researchers and educators to design and/or adjust educational practices according to students’ needs to promote self-authorship in the corresponding dimension.

Second, by focusing on the Chinese students, this study facilitates our current understanding on said students' learning experiences in U.S. engineering doctoral programs from an integrated perspective. Our preliminary results suggested that being exposed to U.S. engineering doctoral education has allowed said students to approach problems through multiple perspectives, which potentially have helped their development towards self-authorship. Considering the large representation of international students in the U.S. engineering graduate programs, this work serves as a pilot study for applying self-authorship theory among other ethnical groups.

Third, our findings also indicated that the three dimensions of self-authorship theory are intertwined and interconnected with each other. The development in one dimension could affect students' progress on the other dimensions. However, in this case, we focused only on students who have already demonstrated self-authorship in the *epistemological dimension*. Further research is needed to explore the exact relationships between these three dimensions.

Last but not least, our results indicated the important role of the interactions between advisors and students on students' development towards self-authorship. From our interview results, it seemed that the advisors and students were engaged in a mutual process of discussing ideas, formulating solutions, and solving problems. According to Baxter Magolda, there are three key principles to promote self-authorship in students' learning, that is, to "validate learners' capacity to know", to "situate learning in learner's experience", and to "define learning as mutually constructing meaning" (p.41)²². Although not explicitly stated, these principles seemed to be embedded in students' interactions with their advisors according to their descriptions in the interviews. Further research is needed to understand the dynamics between advisors and students and their impact on students' development toward self-authorship.

Conclusion

In summary, this study reports our preliminary findings on Chinese engineering doctoral students' development towards self-authorship in the three dimensions of the theory. The focus on engineering doctoral students allowed for an operationalization of self-authorship theory using students' practical educational experiences. The focus on Chinese international students allowed researchers to gain a preliminary understanding about these students' learning experiences through an integrated perspective, which can serve as an example for similar studies among other ethnical groups considering the large representation of international students in the U.S. engineering doctoral programs. Future studies will explore various factors that are related to students' development toward self-authorship, which can potentially help promote self-authorship among students.

References:

1. National Science Foundation (2009). *Doctorate recipients from U.S. universities*. Retrieved on Jan 5, 2014, from <http://www.nsf.gov/statistics/nsf11306/index.cfm>
2. Corley, E. A., and Sabharwal, M. (2007). Foreign-born academic scientists and engineers: Producing more and getting less than their U.S.-born peers? *Research in Higher Education*, 48(8), 909–940.
3. Seagren, A. T., and Wang, H. (1994). Marginal men on an American campus: A case of Chinese faculty. Paper presented at *the annual meeting of the Association for the Study of Higher Education*, Tucson, Arizona.

4. Wang, W. (2009). Chinese international students' cross-cultural adjustment in the U.S.: The roles of acculturation strategies, self-construals, perceived cultural distance, and English self-confidence. Retrieved from ProQuest, The University of Texas at Austin.
5. Ye, Y. (1992). Chinese students' needs and adjustment problems in a U.S. university. Retrieved from ProQuest, The University of Nebraska, Lincoln.
6. Baxter Magolda, M. B. (2001). *Making their own way: Narratives for transforming higher education to promote self-development*. Sterling, VA: Stylus.
7. Baxter Magolda, M. B. (2008). The evolution of self-authorship. In M. S. Khine, (ed.), *Knowing, knowledge and beliefs: Epistemological studies across diverse cultures*. New York: Springer.
8. Perry, W. G. (1970). *Forms of intellectual and ethical development in the college years: A scheme*. New York: Holt, Rinehart and Winston.
9. Belenky, M. F., Clinchy, B. M., Goldberger, N. R., and Tarule, J. M. (1986). *Women's ways of knowing: the development of self, voice and mind*. New York: Basic Books.
10. Kuhn, D. (1991). *The skills of argument*. Cambridge, England: Cambridge University Press.
11. Baxter Magolda, M. B. (1992). *Knowing and Reasoning in College: Gender-Related Patterns in Students' Intellectual Development*. San Francisco, CA: Jossey-Bass.
12. King, P. M., and Kitchener, K. S. (1994). *Developing reflective judgment: Understanding and promoting intellectual growth and critical thinking in adolescents and adults*. San Francisco: Jossey-Bass.
13. Kegan, R. (1994). *In over our heads: The mental demands of modern life*. Cambridge, Massachusetts: Harvard University Press.
14. NSF (2010). *Foreign Science and Engineering Students in the United States*, Retrieved on Jan 5, 2014 from <http://www.nsf.gov/statistics/infbrief/nsf10324/>
15. Pavelich, M. J., and Moore, W. S. (1996). Measuring the effect of experiential education using the Perry model, *Journal of Engineering Education*, 85(4), 287–292.
16. Felder, R. M., and Brent, R. (2004). The Intellectual Development of Science and Engineering Students. 1. Models and Challenges, *Journal of Engineering Education*, 93(4), 269–277.
17. Sattler, B., Turns, J., and Mobernd, K. A. (2012). Supporting self-authorship development: The contribution of preparedness portfolios. *2012 Proceedings of the American Society for Engineering Education*, San Antonio, TX.
18. Baxter Magolda, M. B. (1987). Comparing open-ended interviews and standardized measures of intellectual development, *Journal of College Student Personnel*, 28, 443–448.
19. Zhu J., (2013). Personal epistemological development of Chinese engineering doctoral students in U.S. institutions: An application of Perry's theory. Retrieved from ProQuest, Purdue University.
20. Merriam, S. B. (2006). Transformational learning and HIV-positive young adults. In V. A. Anfara, Jr. and N. T. Mertz, (eds), *Theoretical frameworks in qualitative research*. Thousand Oaks, California: SAGE Publications: 23–38.
21. Creswell, J. W. (2008). *Research Design*. London: Sage Publications.
22. Baxter Magolda, M. (2004). Learning Partnerships Model: A framework for promoting self-authorship. In M. Baxter Magolda, and P. M. King, (eds), *Learning partnerships: Theory and models of practice to educate for self-authorship*. Sterling, Virginia: Stylus.