A New Framework to Explore the International Vision of College Teacher

Xueping Zhang
School of Mechanical Engineering, Shanghai Jiao Tong University,
Shanghai 200240, China.

Xijuan Liu (Corresponding author)
Mechanical School, Shanghai Dianji University,
Shanghai 201306, China

Abstract

Aiming to address the methodology to explore and broaden college teachers' international vision and horizon for engineering education of college students or engineers, this paper proposed an exploration framework based on Johari Window model. The framework of international vision exploration for teachers includes four zones: open/active vision, called Zone A; hidden/sleeping vision, called Zone B; blind/potential vision, called Zone C; and unknown/darkness vision, called Zone D. The four zones' characteristics and formation mechanisms were generally analyzed, the corresponding driving forces were then identified in order to help transform teacher international vision within Zone B, Zone C and Zone D into Zone A. To provide the effective and feasible approach, several significant factors including culture tension, original vision conflict and pure curiosity for unknown were then determined in exploring and improving teacher's international vision in terms of curiosity, inner creativity, potential vision, career development, and worldwide adaptability on engineering education evolution.

Keywords: college teacher international vision; exploration framework; engineering education; Johari Window model

1. Background Introduction

Internationalization and globalization in engineering education have become stimulating trends during recent decades in response to the rapid development in international industries, internet communication, artificial/intelligent computer, and promptly convenient transportation [1]. More and more engineering college students or engineers have been required to work outside their own countries and open to completely different environments associated with various cultures and unpredictably potential conflicts. University/college teachers face the upstream of engineering education, thus it is urgent and does make significant to explore teachers' international vision for engineering education to benefit students (potential future engineers) at the first beginning in terms of their international awareness, openness, adaptability, flexibility and career development

Johari window model is a psychologically effective tool firstly presented by Joseph Luft and Harry Ingham in 1955 [2] as a communication model that can be used to improve understanding and self-understanding between individuals within a team, a group, a community, or potential cooperative research or projects.

Based on the fundamental mechanisms of disclosure, self-disclosure, and feedback, the Johari Window can also be employed to improve a group's relationship with other groups. This research aims to develop an improved framework in helping college/university teachers explore and enlighten their international visions on engineering education in an effective and systematical way based on Johari Window model.

2. International Vision Exploration Framework in Engineering Education

An improved framework was proposed to explore the international vision of college teachers on engineering education, as shown in Fig.1, which is based on the original Johari Window model. The framework includes four vision levels/areas: *Zone A*) Active vision is an open area to student/engineer and teacher. *Zone B*) Sleeping vision is a hidden or invisible to student/engineer, and it is also a passive vision for teacher. *Zone C*) Potential vision is a probably clear and visible to student/engineer. However, this area keeps blind to teacher himself/herself. *Zone D*) Darkness vision is a completely invisible or unknow both to teacher and student/engineer concerning engineering education's future development and potential evolution procedure. Based on the framework, this research focuses on addressing the possible methodology and effective approaches to broaden and improve the international visions of college teachers to achieve a successful engineering education, as indicated by the "Red dotted lines" in Fig 1 to expand the territory of thought of college teacher in his or her professional engineering education.

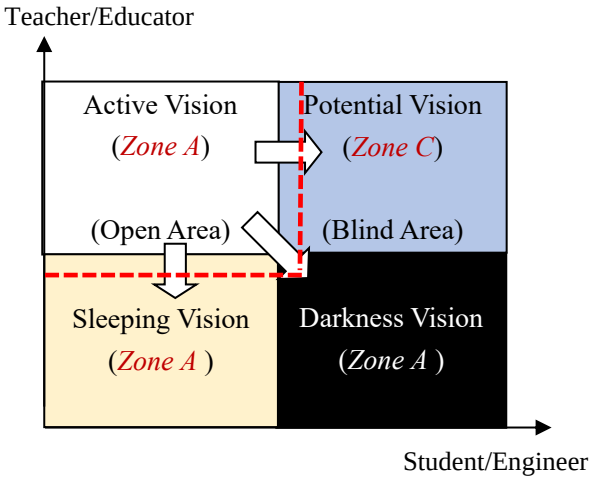

Fig.1. International vision exploration framework for teachers aiming at engineering education.

2.1 Active Vision in Engineering Education

College teacher, who is assumed to be active in engineering education, usually involves class teaching, textbook reading, writing, editing, researching, and communicating with college students and engineers through industry projects' cooperation. Therefore, teacher can effectively share his knowledge, experience, research, and understanding in engineering education with college students and engineers. This analysis means that *Zone A* is a clear and active vision in helping college teacher implement and educate engineering students, and students and engineers can also effectively benefit from the active vision and thorough understanding of college teacher.

2.2 Sleeping Vision in Engineering Education

College teacher has a sleeping vision/horizon including interdisciplinary knowledge, fabulous fundamental research experience, creativity in industry problem solving, *Zone B*, which are hidden or invisible to student/engineer. Due to the restriction of discipline requirement, university regulation, time schedule and activities in class teaching, it is regret that these rich resources are also a passive vision for teacher himself/ herself as if he has never owed such existing teaching practice and organization. Therefore, students and engineers cannot benefit from teachers' hidden capacity until it is intentionally explored by college teacher.

2.3 Potential Vision in Engineering Education

College teacher possesses a potential vision, which is probably clear and visible especially to international students/engineers, however, this area is blind to teacher himself/herself. The potential vision includes teacher's culture prejudice or narrowness, localized professional training, shaped personality associated with cultures and traditions, closed preference, and limited experiences compared with those of the international students and engineers. Thus, *Zone C* is particularly important to arouse the awareness of teacher to enlighten his/her international vision in engineer education.

2.4 Darkness Vision in Engineering Education

Both for teacher and students/engineers around the world, darkness vision is inevitably and completely invisible or unknown concerning the future development and potential evolution of engineering education since tremendous factors are undetermined, changing and developing all the time in different places worldwide, indicated in *Zone D*. These aspects include political and religion's fusion, collision, and conflicts, the rapid development of science and technology. It is related with new materials invention, space exploration, and Artificial Intelligent (AI) robots, and more and more closely international exchanges of students, scientist, engineers, and ordinary persons by means of international cooperation, exchanged students program, conference, dynamic alliance of projects, lab visiting, industry fair, and even personal traveling. The truth poses an imminently great challenge for teachers, students and potential engineers in developing a matched vision for a potentially successful engineering education

3. Driving forces to active sleeping vision

To activate the sleeping vision *(Zone B)* of college teacher, it is crucial to discover the driving forces to stimulate and draw teacher's attention to the sleeping knowledge, experience and understanding hidden to students. Three active approaches were proposed to sharpen teachers' awareness and waken their sleeping vision, and eventually help them achieve the transformation from passive vision to active vision.

3.1 Try A Variety of Flexible Teaching Methods

Classroom teaching is a traditional approach in delivering the fundamentals, principle, processes, and knowledge framework of analysis, synthesis, application and optimization in engineering education for students and engineers. However, a variety novel and creative teaching methods are needed to stimulate students' interests, curiosity, and particularly help discovery teacher's potentially sleeping vision that has

already been incubated during long-term teaching and research experience. For example, I usually select topics proposed by engineers in manufacturing industry, my research projects cooperated with companies, and hot research topics in manufacturing front as course projects. I have found it is helpful to relate my teaching to industrial popular topics, interests, teams, and cooperated companies and factories to get my students fully guided in manufacturing discipline. Students have applied invention patent through completing their course projects. I clearly realized how it is stimulating for students to taste the pleasure of achievement incorporated with my course. By means of this approach, I realize that such teaching activity can also greatly benefit me by exploring and manifesting my hidden professional training and experience which I have obtained from my cooperative experience with other professors, engineers, experts, and even my graduate students.

3.2 Combination of Teaching and Scientific Research

Generally, teachers in engineering education possess abundant experiences due to their deeply involvement in industry practice concerning engineering problem solving and scientific, fundamental, hot topics in academic circle [3]. Thus, it is a potential approach to merge the research experience into teaching process in engineering education. This helps stimulate the interest of students and remind teachers of their wonderful hidden capacity and vision developed in research experience. This is a powerful activity in mutually benefiting students and teachers in terms of professional development, aspiration enlightenment, problem solving capacity improvement, and international visions exploration.

3.3 Intentionally Break through Discipline Boundaries

Another important approach is intentionally managing to break the boundaries of disciplines, especially the rigid boundaries of engineering, science, general education, philosophy and culture, which unconsciously shaped teachers' thinking pattern and boundary. To realize the truth, it is an intentional activity to breakthrough teachers' possible rigid thinking especially after decades in engineering education, since the knowledge framework, design steps, material selection, and optimization procedures have been standardized, modularized and serialized in engineering education. The logically defined framework is helpful in shaping the thinking of students and teachers themselves. However, it is unfavorable in developing critical thinking and creativity for the future product, market, competitiveness associated with international visions [4].

Several potential approaches are presented here to illustrate such type of efforts: 1) Surpass discipline boundary by paying attention to natural things including the biological world in terms of function, structure, material, mechanism, energy, resources, transition, and efficiency. 3D printing, as a popular manufacturing technology, is a good example that human being learned from natural process, which is an opposite manufacturing mode compared with the subtractive processing such as machining, grinding and honing. 2) Aesthetic design in mechanical product usually requires a good sense of Art and Literature, human sensitivity, intuitive power, which blur the boundaries of rational and sensible, static and dynamic, rigid and flexible thinking [5]. 3) Survival and sustainable products possess a long-term life with the communication not only engineering function and scientific foundation, but also philosophical consideration and cultural respect. Those aspects provide an international vision without any constriction

from discipline boundaries.

3.4 Challenge and Refresh Teaching Pedagogy by Interacting with Peers

To share teaching experience with peer is an excellent approach to mutually explore teaching capacity and international vision. I do benefit from sharing with senior professor, young professor, and colleagues during my teaching process. For example, when the "Digital Manufacturing Superior Course Prize" was proposed, five professors participated the cooperative teaching activity, honestly shared, and intimately worked with each other during the application procedure. It made me surprised that my hidden creativity in teaching has been stimulated through the cooperative teaching activities. Based on the intuitive knowledge, I realize that challenging and refreshing teaching pedagogy is an effective approach to explore international vision, which could be incorporated with active interaction with peers. To deepen the cognition, I initially applied and took part in the construction of General Education with my colleagues at Shanghai Jiao Tong University. As a teaching assistant, I participated the Summer Course of IE470 delivered by a professor of Purdue University. I helped design and participated the Summer Course of Critical Thinking and Creativity presented by a professor from IAESTE (The International Association for the Exchange of Students for Technical Experience). Those experiences strengthen the effectiveness of the proposed method in exploring international vision hidden in my inner understanding

In addition to the methods mentioned above, it is particularly important to conduct self-reflection the familiar teaching methods and intentionally cooperative teaching activities interaction with international peers as promoted by several international organization such as U21 (Global Teaching and Learning of 21 Universities) and The Higher Education Academy in Australia.

4. Tension Conflict to Explore the Potential Visions

It is quite difficult to explore the potential vision, *Zone C*, blind area of teachers although it is clear and easy for students and engineers to realize. What is the true situation for the teacher to ignore the blind spot? Why is it possible for a teacher to blind to this cognition? What is key to overcome the blind spot? Based on my understanding, the most important point is firstly sensitive to the tension conflicts among teacher, students, and engineers, and then manage to reflect from fresh angles in terms of different cultures, religious beliefs, nationalities, ages, experiences, personal preferences, and personalities during tension conflicts [6]. The attempt will help college teacher broaden their horizons and improve their international vision, which will help college teacher overcome their originally narrow visions, a great meaning process for teacher professional development.

4.1 Culture Tension Conflict

The primary concern in international vision for engineering education is to identify and solve the potential tension conflict from different cultures [7]. Therefore, it is a crucial consideration for teacher to actively learn, contact, touch, understand, and communicate with other cultures to expand their narrowness of traditionally local visions. College teachers can strengthen their international vision by actively opening to international students, professors, experts, conference, exhibitions.

4.2 Religious Tension Conflict

Religion tension conflict is an extremely important factor for college teachers worldwide, although this issue was ignored in engineering education [8]. Thus, college teachers should not be blind to it anymore since religion conflict is the root reason for culture tension. An effective method is to actively learn, tolerate and closely pay attention to the feedbacks of students with different backgrounds associated with religious regulations, distinct prohibitions such as typical shapes, colors, materials, customs, and preferences. It is a cumulative and interesting exploration process for college teachers to share and understand different religions and their conflicts and give reasonable consideration in engineering education. Therefore, this effort can gradually explore teachers' international vision in engineering education.

4.3 Nationality Tension Conflict

Nationality is a critical problem to call college teachers' attention in engineering education worldwide, especially when teachers give lectures or presentations to undergraduate students, graduate students or trainees with different nationalities, since some topics are sensitive, aggressive, misunderstanding, or irritating related to nationality. When college teachers face international students, it is a basic quality to be sensitive to the feedback from students due to a fact that patriotic education is still very popular at present. It is a good way to make students' nationalities known at first class and honestly share their preference [9]. I truly benefit this method and develop necessary awareness during my teaching experience.

4.4 Experience Tension Conflict

In most cases, college teachers possess rich and colorful experience in design, implementation, optimization, practice, teaching, research, communication, presentation concerning engineering education. However, students usually lack such experiences. This situation can arouse tension conflicts in understanding some concepts, principles, mechanisms, processes, etc. concerning engineering education. For example, an undergraduate student cannot design a successful casting gating system due to their lack of industry practice and experience. College teachers should not feel angry or enraged by students' performance [10]. The design task explores the vision of college teachers to realize the reality and learn to share with students' their practical experience.

4.5 Original Vision Tension Conflict

This section is particularly adaptive for graduate students or engineers since their backgrounds and experiences vary greatly [11]. The original visons can result in tension conflicts among teachers and students during teaching process, task assignment, and project practice. For example, one student designed a very complex product given function requirements, and the other student design a simple product to meet the same function requirements. The first student got low grade and the second student got high grade. The first student talked to me that the grade is unfair since he spent more time and resource on the design, but the other student's design is too simple to cost more time and energy. I made great efforts to convince him that it is misunderstanding to spend more time, energy, resources, processes, costs to produce a very complex product if there is a much simpler substitute.

4.6 Expectation Tension Conflict

The expectation of students usually cannot be fulfilled by college teachers in engineering education. However, this phenomenon provides a fabulous method to explore college teachers' international vision by identifying the critical points blocked by the students' expectation for college teacher [12]. For example, Student 1 expects that teacher give more details and explanations on the lecture. Student 2 hope teacher combine class content with practical application and project practice. Student 3 are eagerly to visit Factory, Lab, Industry site, Exhibition for engineering education. As shown in Fig. 2

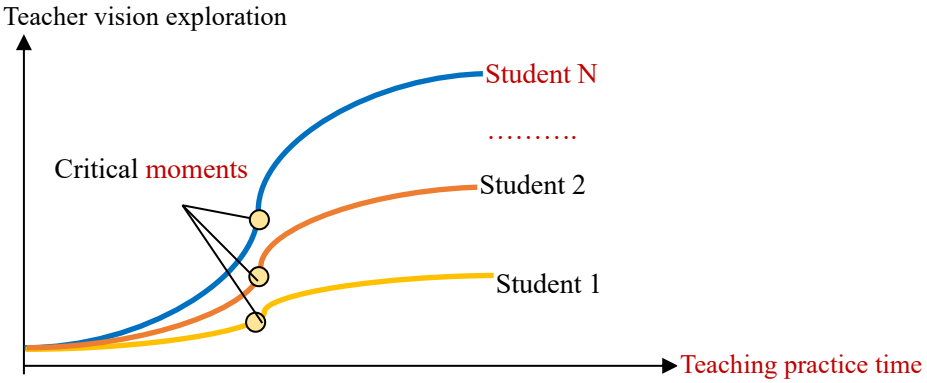

Fig.2. Expectation tension conflicts between college teachers and students on engineering education.

However, there exists the critical point for each student expectation, which can be transferred as time allocation of lecture content organization. Therefore, full understanding international students' expectation and identifying their corresponding critical points are the fundamental capacity for college teachers. The capacity development is an effective process in exploring college teachers' international vision.

5. Curiosity to Enlightening Darkness Vision

Although future trend in engineering education is completely unknown to teacher and students/engineers, it still makes significant to predict, prepare and actively discovery an effective and efficient orientation to improve, explore, and broaden international vision of college teachers. Based on logical and critical thinking and understanding, curiosity has been the everlasting driving forces in human understanding improvement and international vision promotion in science, art, architecture, machine, various products and technology evolution [13]. Thus, born curiosity should be the greatest driving forces to enlighten the darkness vison, *Zone D*, of college teachers and students. Several aspects related with curiosity will be discussed to particularly explore the darkness vision of college teachers for engineering education.

5.1 Curiosity for Solving Existing Difficult Problems

In engineering education, the most excited capacity for college teachers is to stimulate student's curiosity to resolve various practical problems, especially difficult problems or puzzles concerning the existing products or future developed application. By means of proposing and incorporating difficult problems in industry application into lecture content, college teachers can effectively stimulate students' passion and desire to solve practical puzzles encountered in engineering practice.

Assumed college teachers can well guide and manage students' passion for problem solving, college teachers can explore their vision for future and enlighten their present darkness vison. For example, to resolve automobile weight reduction, an existing issue, college teachers, students, and engineers have developed tremendous new materials, mechanisms, processes, and technologies to improve automobile performance. This effort explores college teachers' vision, especially international vison for engineering education.

5.2 Curiosity for Challenging Existing Engineering Product, Production Concept and System.

Curiosity will never be satisfied with existing and the known things including product, service, production, system, etc. As college teachers in the for engineering education, curiosity for unknown area is to challenge existing engineering product and production in terms of materials, structures, quality, efficiency, effectiveness, cost and psychological satisfaction. For example, group technology, lean production, TRIZ (Theory of Inventive Problem Solving) [14], agile manufacturing, smart manufacturing, and intelligent production, etc. which have been developed in challenging existing products and production system, provide novel, creative or newly opened visions for college teachers on engineering education.

5.3 Curiosity for Breaking Thinking Boundaries

College teachers should keep the curiosity for breaking their own thinking boundaries and further students' thinking dimensions. In addition to rigid discipline boundaries, there are many invisible thinking boundaries formed and shaped by culture, experience, community, practice, personality, etc. Thus, identification and awareness of thinking boundaries are necessary to drive the curiosity for breaking those thinking boundaries. Curiosity provides an everlasting driving force to explore college teachers on engineering education. As indicated by Yue [15], teacher professional development is not an only one step but a continual and sustainable process by exploring and keeping awareness of what is actively happening around the world.

5.4 Curiosity for Improving Self-Understanding

Compare with K-12 schooling, higher education teachers demand more precise, comprehensive, enlightening knowledge and skills [15]. The development of human mind and understanding capacity is always an attractive topic for college teachers, students, and engineers. Curiosity for developing human mind and understanding constitutes a dynamic and positive driving force to explore college teachers' creativity with international vision in engineering education. The professional quality of college teacher will help students develop adaptability for future engineering development around the worldwide. To achieve the curiosity for improving human mind and understanding, it is especially helpful to attend international conference, organize lab visiting, enrich factory experience, propose project solution, multi-read textbook, videos in Youtube, Google, Wiki, Baidu, handbooks, reports, keep open mind to online Journal, electrical books, and exhibition. Especially it is necessary capability of college teacher to keep sensitivity and awareness of new theories, potential thinking, and newly developed technologies associated with new software and platform in industry [16].

6. Summary and Conclusion

Based on Johari window model, this paper presented a methodology framework to explore college teachers' international vision in stimulating students' and engineers' curiosity for engineering education. Four typical zones of college teacher vision/thinking were firstly analysed and the according approaches were proposed to explore college teacher international vision for engineering education step by step. Those methods were summarized in Table 1.

Table 1: Approach to explore the international vision of college teacher in engineering education

Method No.	Be transferred into Active Vision (Open Area, *Zone A*) from		
	Hidden Vision Sleeping Area: *Zone B*	Blind Vision Potential Vision: *Zone C*	Darkness Vision Unknown Future: *Zone D*
1	Try a variety of flexible teaching methods	Identify culture tension conflict	Curiosity for solving existing difficult problems
2.	Combination of teaching& scientific research	Sensitive to religious tension conflict	Curiosity for challenging existing product, service or production system
3.	Intentionally break through discipline boundaries	Actively aware of nationality tension conflict	Curiosity for breaking thinking boundaries
4.	Challenge and refresh teaching pedagogy by interacting with peers	Actively reflect on experience tension conflict	Curiosity for improving human mind and self-understanding
5.	Self-reflection familiar teachering methods	Original vision tension conflict awareness	Curiosity for newly developed technologies
6	Cooperative teaching activities interaction with international peers	Expectation tension conflict awareness	Curiosity for new theories and potential thinkings

In order to explore the hidden vision, *Zone D*, intentionally active practices are necessarily required for college teacher to awaken and actively reflect their rich and colourful experiences, knowledge, capacities accumulated during teaching and research processes.

In order to open blind vision of college teacher, it is crucial to identify the driving forces including various tension conflicts such as culture, religious beliefs, intuitive feelings, experience, reasoning habit, language, etc. to discovery the potential areas.

In order to enlighten the darkness vison *Zone D* of college teacher in engineering education for unknown or unclear future development, curiosity is determined as the most significant cutting edges. It provides an effective approach by solving existing difficult problems, challenging existing product, service, industry practice, production system, breaking human thinking boundaries, and improving human mind, understanding and self-understanding toward unknown, unclear or dark areas for human being.

Acknowledgment

The authors wish to thank the Ministry of National Education of China for its financial support under Special Funding Project for the Philosophy and Social Science Prosperity with the grant No. 18JDGC026.

7. References

[1] L. Darling-Hammond. "Teacher education around the world: what can we learn from international practice?" European Journal of Teacher Education, 2017, 40(3), pp. 291-309.

[2] Luft, J. Ingham, H. "The Johari window, a graphic model of interpersonal awareness". Proceedings of the western training laboratory in group development. UCLA, Los Angeles, USA, 1950.

[3] V. Baumfield, M. Butterworth, G. Downey, S. Higgins, M. Lin, D. Moseley, M. Rockett. "Thinking skills approaches to effective teaching and learning: what is the evidence for impact on learners?" London: EPPI-Center, 2004.

[4] M.M. Clapham, D.H. Schuster. "Can engineering students be trained to think more creatively?" Journal of Creative Behavior, 26, pp.156-162.

[5] D.H. Cropley, A.J. Cropley. "Fostering creativity in engineering undergraduates." High Ability Studies, 11(2), pp. 207-219.

[6] H.C. Boucher, K. Peng, J. Shi, L. Wang. "Culture and implicit self-esteem: Chinese are good and bad at the same time." Journal of Cross-Cultural Psychology, 40(1), pp.24-45.

[7] L. Ji, K. Peng, R.E. Nisbett. "Culture, control, and perception of relationships in the environment." Journal of Personality and Social Psychology. 78(5), pp. 943.

[8] B. Rogoff. "The cultural nature of human development." Oxford: Oxford University Press, 2003.

[9] K. Loibl, N. Rummel. "The impact of guidance during problem-solving prior to instruction on students' inventions and learning outcomes." Instructional Science, 42, pp. 305-326.

[10] M. Ben-Peretz, M.A. Flores. "Tensions and paradoxes in teaching: implications for teacher education." European Journal of Teacher Education, 41(2), pp. 202-213.

[11] H. Niemi, A. Nevgi. "Research studies and active learning promoting professional competences in Finnish teacher education." Teaching and Teacher Education, 2014, 43, pp. 131-142.

[12] D.V. Johnson, R.T. Johnson. "The use of cooperative procedures in teacher education and professional development." Journal of Education for Teaching, 2017, 43(3), pp. 284-295.

[13] D.W. Johnson, R.T. Johnson, E.J. Holubec. "Cooperation in the classroom." 9th ed. Edina, MN: Interaction Book Company, 2015.

[14] Y.W. Sun, S.Ikovenko. "TRIZ: the golden key to innovation I." Beijing: Science press, 2019.

[15] X.Y. Yue. "Exploring effective methods of teacher professional development in University for 21st century education." International Journal of Innovation Education and Research, 2019, 7(5), pp. 248-257.

[16] S.L. Russo, D.C. Gumarães, C.M.B. Cruz, C.C.S. Silva. "Patents and articles related to cooperation in universities, using poisson regression models." International Journal of Innovation Education and Research, 2020, 8(5), pp. 43-59.