



The Power of Community of Practice: a Portrait of Attitude Change in Science Teachers' Information-Based Teaching

Ying Xu and Taotao Long* and Zhicheng Dai

Central China Normal University, Wuhan, 430079, China

*taotaolong@mails.ccnu.edu.cn

Abstract. With the rapid development of information technology, educational informatization has become an important means to improve the quality of education. As an important force in the development of educational informatization, teachers' development of information-based teaching attitudes is of great significance to improving the quality of education. This study adopted the ABC attitude model as a theoretical framework to explore the current situation and development of a high-marginalized science teacher's attitude towards information-based teaching in a community of practice through portrait(a social qualitative research method). The findings show that the community of practice enhanced the development of information-based teaching attitudes through giving support to cognition, affect, and behavior tendency.

Keywords: information-based teaching, attitude, community of practice, teacher professional development

1 Introduction

With the rapid development of technology and the advent of an information-based society, educational informatization has become an important means to improve the quality of education[1]. Teachers, as an important force in this transformation, the development of their information-based teaching attitude is of great significance to improving the quality of education[2]. However, many studies focus on the information-based teaching ability, but few focus on their attitudes.

The community of practice(CoP) is widely used in the professional development of teachers[3], and there are some research has shown that CoP can influence teachers' attitudes[4]. But little attention is paid to their influence on teachers' information-based teaching attitudes

The ABC model serves as the theoretical framework in this study, defining attitudes in terms of cognition, affect, and behavioral aspects. Taking a highly marginalized science teachers as the exemplar, this study explores the current situation and influence of a CoP on the development of an attitude towards information-based teaching.

2 Literature Review

2.1 Information-based Teaching Attitude of Teachers

Information-based teaching is a teaching method that utilizes information technology to modify both teaching methods and learning styles in order to enhance teaching quality and effectiveness[5]. The current research status of teachers' information technology teaching attitudes highlights the significance of this ability in enhancing classroom teaching[6]. With increasing recognition of the importance of IT integration, scholars have delved into the impact of teachers' attitudes on their willingness and behavior regarding technology use in the classroom[7]. This research emphasizes the need for practical application of IT teaching ability, along with empirical studies to identify the influencing factors and improve strategies in different regions and schools[8]. This is essential to provide teachers with practical guidance and assistance in enhancing their IT teaching ability.

2.2 Community of Practice(CoP)

CoP refers to a group of individuals who share a common interest in a particular domain of human endeavor and engage in a collaborative learning process that fosters connections among them[9]. This learning process takes three forms: mutual engagement, a joint enterprise, and a shared repertoire[10]. CoP is based on real teacher practice problems, emphasizing community and open communication among participants, crucial for teacher professional development[11]. CoP effectively changes participant attitudes, as seen in a study where actively engaged in-service teachers reported more positive environmental attitudes[12]. Participant attitudes towards CoP also impact its effectiveness[13].

3 Theoretical Framework

Rosenberg et al. (1960) proposed the ABC attitude model, linking cognition, affect, and behavior[14]. Sears et al. (1991) clarified these terms in the context of individual subject knowledge, emotions, and action tendencies[15]. The model is widely applied in consumer behavior to examine attitude-behavior relations and is a useful tool for such explorations.

In this study, The ABC attitude model was employed as the theoretical framework to examine the current status of attitudes towards information-based teaching among a non-tenured science teacher in a weak primary school, and to explore how a community of practice can modify the teacher's attitudes towards information technology development through two-wheel portrait.

4 Method

4.1 Methodology

Portraiture, a qualitative method combining aesthetics and empiricism, was chosen for this study due to its focus on illuminating human experiences within social, cultural, and historical contexts and its recognition of participants as knowledge co-constructors with inherent imperfections[16]. Validity relies on systematic data collection, self-reflection, and bias examination. As an insider-outsider, I sought "deviant voices" and ensured authenticity through participant feedback, refining interpretations in the exploration of CoP lived experiences often overlooked in academia.

4.2 Context

J School is located in Wuhan's Qingshan district, an "urban village" within an industrial park. It primarily serves landless and migrant populations, many facing urban poverty[17]. As a representative school in this urbanization context, it educates migrant workers' children but struggles with limited qualified teachers.

The Science Education Club at C University, led by undergraduates and primarily consisting of pre-service science teachers with an AI background, found J School while seeking teaching practice opportunities and have been volunteering there since winter 2022. They created a school-based science course, teaching 45-minute classes every Friday during spring and fall semesters, and held discussions with local teachers. The club also invited faculty to advise on instructional design and science teaching.

I chose J School and the Science Education Club at C University due to my special connection as the organizer, which provided opportunities to build strong relationships with all involved, including Mrs. H (part-time science teacher), club members, and Dr. T (faculty advisor). My involvement and close ties facilitated observations and in-depth interviews.

4.3 Participants

Ms H, Dr. T, and club member Miao, were chosen based on their involvement with information technology teaching. Others also contributed. The choice of focal participants was based on their level of engagement with information technology teaching.

Ms H, female, aged 40, was the sole science teacher in J school, responsible for teaching science from Grades 3 to 6. She obtained an associate degree in Chinese literature in the early 2000s and joined J school in 2016. She worked as a non-tenured Chinese teacher for four years before being asked to teach science due to a district educational requirement. She had been a substitute science teacher for two years at the time of this study.

Miao was a key member of the science education club. As a sophomore, his proficiency in web-based information search and sensitivity to new technologies made him

a "technology superstar" in the club. His desire for authentic science teaching experience in primary school led him to join the science education club and actively engage in the voluntary teaching program at J school.

Dr. T, female, aged 35, was the faculty advisor of the science education club at C university. She earned her doctoral degree in educational technology in the US and worked as a tenured faculty member in the science education program at C university for five years.

5 Finding

5.1 The First Portrait

5.1.1 "It's Advanced for us."

From the first visit in winter 2022, "Out-of-date," it is my initial impression on the science classroom, together with the equipment and resources for the science course in J school. There were many basic laboratory equipment, such as beakers, measuring cylinders, microscopes, counter balances and so on. J school currently still used traditional science classrooms, which had a significant gap between them and "smart classrooms" and "maker classrooms" being configured in many other schools in Wuhan. After this visiting, I had an opportunity to talk with the headmaster and Ms. H. When expressing why the school did not introduce some scientific experimental teaching aids with higher information technology level, like robots and electronic building blocks, Ms. H indicated with a wry smile, "I know them, but they are too advanced for me to use, I would waste them." The headmaster explained, "We can apply for funds for purchase, but we don't know what to purchase, what you said were too advanced it's a waste." This made me feel their emotional inferiority using information technology in teaching.

5.1.2 "I have no Time or way for more Useful Resources".

Ms. H had obvious difficulties in finding suitable teaching resources. My first observation on Ms. H's science class teaching also shocked me. In a third-grade science class "Insect," the PPT slides were searched directly on the browser at the beginning of the class. At the end of this class, she played two videos, which were also just searched on Bilibili①, spending nearly five minutes in the search. It was my first time seeing a teacher searching the PPT slides in class. I didn't ask why she did not prepare well before the class, but the main reason might be lack of time to explore or produce resources due to her work load. As the only science teacher of J school, she was responsible for teaching the science courses for Grade 3 to 6. After class, I asked Ms. H for the channel to obtain curriculum resources. She took out her phone and searched out a WeChat group②, "I usually see their sharing in the teachers' group in our district. I don't think they are suitable, but I have no time or way for more useful resources." When I asked if Ms. H had other ways for resources, she said with a tone of confusion, "I just use the browser to search, isn't that enough?" I feel that Ms. H has a problem of information blockage in her understanding of information-based teaching.

5.1.3 “It’s not Necessary to use”.

The first time I got to J school, I expressed my need to try the recording equipment and Ms. H. took me there. The recorder could record three pictures on three cameras. I asked Ms. H if she would turn on the device, “I don’t use these devices, so I’m not very good at using them.” Ms. H’s answer surprised me, so I asked her how she usually recorded classes, “I haven’t had the opportunity to record a lesson. Generally, people record lessons to participate in competitions. And it was troublesome to use it.” Besides, some experimental equipment had accumulated dust in the laboratory. “This is a uniform allocation from the government, but it’s not very necessary for classes. Now there are many videos that can be played directly.”

5.2 The Second Portrait

5.2.1 “I got lots of good stuffs”.

In the CoP, there were many opportunities to realize knowledge sharing based on real needs. Miao, as a “technology superstar” in the club for being proficient in web-based information search and sensitive to novel technologies, brought Ms. H a lot of informational teaching resources. During a post-class discussion at J School, Dr. T mentioned “natural notes,” but Ms. H and the other participants seemed perplexed. When Dr. T attempted to elaborate what natural notes entailed, Miao swiftly shared images of natural notes created by elementary school students, which he found online, in their WeChat group. Ms. H expressed her interest in the “natural notes” and was surprised at his information search efficiency, “I cannot find appropriate resources. Can you help me?” We both said it was okay.

Given the wave of innovation sparked by generative AI in spring 2023, Miao had not only been guiding club members to harness it for creative inspiration but also recommended it to Ms. H for her professional development. In the discussions, Ms. H expressed her distress regarding finding appropriate substitute experimental materials for her after-school scientific activities. Without hesitation, Miao responded, “Ask ChatGPT.” Initially, Ms. H expressed her skepticism, “ChatGPT? I haven’t learned this before. It is AI, seems to be profound and difficult to use. I shouldn’t be able to use it.” To alleviate her doubts, Miao promptly pulled out his computer and demonstrated how to use it.

During the final interview, Ms. H talked about the ChatGPT. The ChatGPT’s answer was comprehensive and no advertising. It’s better than Baidu^③. I got lots of good stuffs.” After that, Ms. H. expressed her gratitude to Miao, “Every time I couldn’t find resources, he was always patient in teaching me how to search. He also provides me useful and appropriate resources.”

5.2.2 “You can do it, me too.”

After demonstrating how to use the ChatGPT by Miao, Ms. H expressed her idea of trying it out in a small and inquiring tone, “Can I asked it some questions?”. As she saw how simple it was to operate—just opening a webpage in a browser—and how one

could treat it like an expert on any topic, asking questions and receiving insightful answers, her demeanor shifted. Although she didn't get the answer she wanted in the process, Miao and Dr. T taught her how to ask questions. Finally, Ms. H got the answer that satisfied her. She was astonished, "I can't believe it. These advanced technologies are not so difficult to use".

The club members, having studied relevant professional knowledge of integrating technology in the classroom, utilized various educational software and tools to enhance their classes. In Miao's class, he incorporated a random attendance system through an online platform, which allowed him to easily keep track of student participation. Additionally, he incorporated dynamic visuals into his lesson plans. Miao presented a vivid image of small molecular particles being attracted to a material through van der Waals forces. There were some students were intrigued and eagerly gathered around the computer to witness this phenomenon. In the after-class discussion, Ms. H expressed her feeling about this, "This effect is very good."

In the interview, Ms. H described shared, "I feel like I have a partner. Every time I saw you can use the technologies well in the class, it made me more confident and let me want to try. You can do it, me too."

5.2.3 "I can have a try."

I was surprised at Ms. H's acceptance of new information technology. At the end of the program, we were planning to have a tablet-enhanced class. Ms. H decisively agreed and expressed that she hoped to learn during the process. There was an emergency situation that required knowledge of the computer configuration of the school's science laboratory. When we were wondering if Ms. H had ideas on computer configuration, she immediately replied, "I can have a try." Then she sent us the information we needed with our remote online guidance.

I'm confident in her ability to independently generate resources for science teaching using information technology. Ms. H shared her plan for an after-school science program at J School. When discussing interesting science experiment videos shared by club members in a WeChat group, she mentioned designing new activities for the program. When suggested to use existing designs, she explained the difficulties in conducting and material preparation for experiments, considering the school's limitations. She's considering using ChatGPT for ideas on experiments suitable for J School students.

6 Conclusion

This study conducted two rounds of portraits from the perspective of three aspects of ABC attitude model, revealing how a high-marginalized science teacher achieving changing information-based teaching attitudes by joining a CoP.

Using the ABC attitude model, we discovered its broad applicability in new research areas. Typically employed in consumer behavior to examine the link between attitudes

and actions, it's seldom used in teacher professional growth. Our study reveals the model's utility in comprehending teachers' attitude on information-based teaching and how it evolves.

First portrait's findings reveal a negative attitude towards info-based teaching among high-marginalized science teachers. Inferior campus culture and lack of resources affected their attitude [18]. Low school self-positioning made teachers feel inferior, affecting their confidence to change. High-marginalized teachers lacked proactive external resource provision. When given new opportunities, their behavior tended to avoid it.

This study explores how a Community of Practice (CoP) can facilitate the transformation of marginalized teachers' teaching attitudes towards info-based instruction. Joining a CoP has led to cognitive, emotional, and behavioral shifts towards more positive attitudes towards info-based teaching. CoP emphasizes the role of practice, typically based on classroom-based real-world problems. CoP provides teachers with access to effective and relevant info teaching resources, validated by on-site teachers. Additionally, CoP offers affective support, with collective mutual encouragement and motivation helping teachers overcome their fear of trying new things[19] and embrace new technologies. As teachers share more problem-solving experiences through IT in the CoP, their tendency to use IT to solve teaching problems becomes a behavioral response.

This study has several limitations and future research areas. Limited sample size might not provide conclusive evidence, thus expanding the sample size can enhance reliability and generalizability. Lack of long-term follow-up prevents observation of long-term development and changes of high-marginalized science teachers in the CoP. Longitudinal studies can provide deeper understanding of their growth process and impacts. Future research can further explore the mechanisms underlying teacher attitude changes within CoP.

① Bilibili is a video websites that is very popular in China.

② WeChat is a social platform for publishing and sharing content and similar in concept to Instant Articles on Facebook.

③ Baidu is a Chinese search engine that offers various search results and services, including web, image, video, news, and map searches.

References

1. Yan S, Yang Y. Education informatization 2.0 in China: Motivation, framework, and vision[J]. *ECNU Review of Education*, 2021, 4(2): 410-428.
2. Wang Y C, Miao N F, You M H. Attitudes toward, knowledge of, and beliefs regarding providing care to LGBT patients among student nurses, nurses, and nursing educators: A cross-sectional survey[J]. *Nurse Education Today*, 2022, 116: 105472.
3. Zhao G, Yang X, Long T, et al. Teachers' perceived professional development in a multi-regional community of practice: Effects of beliefs and engagement[J]. *Learning, Culture and Social Interaction*, 2019, 23: 100347.

4. Okur-Berberoglu E. The Effect of Ecopedagogy-Based Environmental Education on Environmental Attitude of In-service Teachers[J]. *International Electronic Journal of Environmental Education*, 2015, 5(2).
5. Wang Y. Evaluation of the Information-based Teaching Design Abilities of Educators in Blended Teaching[J]. *International journal of emerging technologies in learning*, 2022, 17(5).
6. Yu, Chunlin, and Bo Mu. "Exploration of Information-Based Teaching Reform of Art Design Courses: Taking "Creative Thinking" Course as an Example." 4th International Conference on Art Studies: Science, Experience, Education (ICASSEE 2020). Atlantis Press, 2020.
7. Zhang H, Dai W, He J. An analysis of the differences in information-based teaching to improve the learning achievements of Chinese higher vocational college students[J]. *Asia Pacific Education Review*, 2023: 1-13.
8. Wang Y, Lin H, She L, et al. The Design and Implementation of Information-Based Teaching Skills Training Platform for Primary and Secondary School Teachers[C]//2022 International Conference on Education, Network and Information Technology (ICENIT). IEEE, 2022: 43-47.
9. Lave J, Wenger E. *Situated learning: Legitimate peripheral participation*[M]. Cambridge university press, 1991.
10. Wenger E. Communities of practice: Learning as a social system[J]. *Systems thinker*, 1998, 9(5): 2-3.
11. Kulavuz-Onal D. English language teachers' learning to teach with technology through participation in an online community of practice: A netnography of webheads in action[M]. University of South Florida, 2013.
12. Okur-Berberoglu E. The Effect of Ecopedagogy-Based Environmental Education on Environmental Attitude of In-service Teachers[J]. *International Electronic Journal of Environmental Education*, 2015, 5(2).
13. AbuRuz S, Al-Ghazawi M, Snyder A. Pharmaceutical care in a community-based practice setting in Jordan: where are we now with our attitudes and perceived barriers?[J]. *International Journal of Pharmacy Practice*, 2012, 20(2): 71-79.
14. Rosenberg M J, Hovland C I, McGuire W J, et al. Attitude organization and change: An analysis of consistency among attitude components.(Yales studies in attitude and communication.), Vol. III[J]. 1960.
15. Sears D O, Funk C L. The role of self-interest in social and political attitudes[M]//*Advances in experimental social psychology*. Academic Press, 1991, 24: 1-91.
16. Lawrence-Lightfoot S, Davis J H. *The art and science of portraiture*[M]. John Wiley & Sons, 2002.
17. Liu Y, He S, Wu F, et al. Urban villages under China's rapid urbanization: Unregulated assets and transitional neighbourhoods[J]. *Habitat International*, 2010, 34(2): 135-144.
18. Marmoah S, Denmar D. The analysis of classroom management in teaching English[J]. *IOSR Journal of Humanities and Social Science*, 2017, 22(1): 72-78.
19. Charbonneau-Gowdy P. Moving outside the box: Researching e-learning in disruptive times[J]. 2017.f

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