

Exploring a Senior Teacher's Change in a Learning Community for Improving Pre-service Teachers' Quality

Ya-Fung Chang and Chia-Ling Hsu

Abstract—In this study, we investigated a senior teacher's change in a learning community which aimed to improve the teaching quality of pre-service teachers. The senior teacher had been teaching Chinese in junior high schools for more than 30 years. In addition to the senior teacher, the participants of the learning community were from a university including three pre-service teachers, two teacher educators (researchers), and a Chinese subject matter expert. At the beginning, the university participants sat in the senior teacher's class and observed his teaching. Then, all the participants prepared a new lesson together and then observed the senior teacher's teaching of this lesson, followed by a discussion meeting. Afterwards, three steps of preparing, teaching, and discussing a lesson repeated to improve each pre-service teacher's teaching practice. Based on the multiple data we collected, the senior teacher appeared to give his students more freedom during the teaching process, and he gained new insights on selecting and designing instructional materials. Furthermore, the senior teacher examined digital materials enthusiastically, and finally used technology in his class initiatively and frequently.

Index Terms—Learning communities, senior teachers, teacher change, technology integration.

I. INTRODUCTION

Professional learning communities have been proposed to be the most effective way for teacher professional development [1]-[2]. However, it is difficult to implement teacher professional learning communities in elementary and secondary schools because isolated culture for ages prevents teachers from collaborating with each other [3]-[5] also reported that teacher learning communities were still in the phase of initiation in Taiwanese junior high schools. Many scholars suggest that university professors collaborate with elementary and secondary school teachers for activating teacher professional learning communities [6], [7].

The teacher learning community in this study resulted in a partnership or collaboration between the university and the school. As researchers, we wanted to find out if teacher change in this community did happen and what aspects of change appeared over time. Furthermore, we were most interested in the aspect of technology integration in instruction because studies have asserted the use of technology in teaching to improve student learning [8], [9]. Research has also showed that senior teachers with so many years of instructional experience, however, seldom apply

technology in their classes [10]-[12] clarified that rather than being unwilling to use technology in teaching, senior teachers lack sufficient competency to do so. In other words, senior teachers need more support in professional development regarding technology integration.

Ref. [13] summarized that teachers' firsthand experience of using technology in the classroom not only increased their computer skills but also affected their teaching beliefs and their commitments to technology. [14] suggested that the focus should be on the change of teaching practices which produced good learning effects. In return, this would reinforce the change of teachers' beliefs and attitudes. Therefore, the learning community in this study aimed to improve teaching practices through classroom observation, follow-up discussion, and lesson preparation. With full support of our learning community, senior teachers' competency in technology integration should be enhanced.

II. LITERATURE REVIEW

A. Teachers' Use of Technology

Scholars point out that technology integration is an evolutionary process and it takes time for teachers to understand, adopt, and integrate technology in instruction proficiently [16]. After conducting qualitative research, [15] described five stages that teachers went through in their uses of technology based on the shifts of teaching modes towards more student-centered approach. In the entry stage, teachers did not have much experience with technology. Their focus was on changes in the physical environment, followed by a series of problems such as discipline, resource management, and personal frustrations. In the adoption stage, teachers became more focused on the functions of technology. When they moved into the adaptation stage, teachers were more concerned about the instructional process for individual student learning and engagement. In the last two stages, appropriation and invention, teachers demonstrated more creative uses of technology in teaching experiments to develop students' higher level skills and standards. This indicates that teachers, no longer constrained by the prescribed functions of technology, began to invent and reinvent the uses of technology in their own teaching. In summary, teachers' pedagogical knowledge becomes more critical in the later stages. To move on to a higher stage, teachers need to enhance their pedagogical knowledge and even to change their teaching beliefs towards more student-centered learning. [16] further promoted an organizational culture which would encourage peer observation, dialogues and reflections, and could give

Manuscript received February 26, 2016; revised May 29, 2016. This work was supported in part by the Ministry of Science and Technology, Taiwan, R.O.C. under the project No. MOST 102-2410-H-032-064.

The authors are with Tamkang University, New Taipei City, Taiwan, R.O.C. (e-mail: yfchang@mail.tku.edu.tw, clhsu@mail.tku.edu.tw).

teachers full support emotionally, technically, and pedagogically.

Studies have indicated that senior teachers with substantial teaching experience seldom use technology in their classrooms [10], [11]. In fact, senior teachers were found to have interest in learning about technology and its effective use in the classroom [17]. Furthermore, senior teachers with a solid base of pedagogical knowledge were considered in a good position to apply technology in instruction [18]. However, lack of sufficient technology skills usually keep senior teachers from using technology in their classes [12]. [18] conducted a case study of a senior biology junior high school teacher and concluded that creating successful experiences of technology integration is crucial as well as sufficient technology support such as technology management. To summarize, these requirements could be met by building teacher learning communities as a platform for young teachers with more technology exposure to share their technology use experience and for senior teachers to contribute their pedagogical expertise. Strongly supported by learning communities, senior teachers are more likely to have courage and confidence in experimenting technology use in their classes.

B. Characteristics of Teacher Learning Communities

Scholars have claimed that teacher learning communities improve teaching practice and student learning [12], [19]. A learning community is a group of people who share common academic interests and goals. Its aim is to continuously improve each other's knowledge, skills, and attitudes through idea exchange, participative learning, and mutual encouragement. A teacher learning community can be defined as a group of educators who share a common belief, vision and goal, and have a commitment of improving student learning continuously by participating in teaching inquiry and problem solving collaboratively. According to scholars, effective teacher learning communities appear to have the following key features: shared vision, values and goals; a collaborative culture with focus on learning; collective inquiry; shared personal practice; action orientation, i.e. learning by doing; continuous improvement; and results orientation [2], [20].

Ref. [21] studied the change process that teacher learning communities went through, and identified three distinct phases: initiation, implementation, and institutionalization. In the phase of initiation, the emphasis was on espoused values and norms. Specific tasks in this phase involved information sharing, professional dialogues, peer lesson observation, and relationship building. Moving into the phase of implementation, there was a shift to focusing on students and high expectations. Specific tasks in this phase involved working collaboratively, sharing outcomes regarding new teaching practice, giving feedback, and creating mutual trust and respect. In the less frequent cases of institutionalization, shared vision actually guided teaching and learning. Specific tasks in this phase involved applying what has been learned to teaching practice, analyzing student learning outcomes, peer coaching and mentoring, and promoting change. [20] assumed a dynamic development of teacher learning communities, perennially evolving with accumulating

collective experience.

Ref. [19] claimed that a key to manage and sustain effective teacher learning communities is input and support from internal and external human resources. Some useful strategies include providing a clear structure and purpose for meetings, addressing the most pressing instructional challenges, providing support from the school system, fostering an atmosphere of trust, monitoring the work of communities and providing constructive feedback, and supporting teachers' sense of efficacy and level of professionalism [20], [21].

C. Implementation of Teacher Learning Communities

Although empirical studies have reported the benefits of teacher learning communities, it is not easy to implement them successfully in Taiwanese elementary and secondary schools because of the isolated culture over the years [3], [4]. Such culture makes teachers unwilling and unaccustomed to working with others, and hence hinders the development of teacher learning communities. [5] conducted a survey investigating teacher professional learning communities in Taiwanese junior high schools, and found that teachers' participation was still in the phase of initiation. In other words, teacher learning communities, currently led by few initiators, were perceived by junior high school teachers at an early stage of exploration and creation. In addition, they found a lower score in "sharing of practice", indicating that teachers seldom shared their instructional resources and teaching experience with others. [24] asserted that only through cooperation between universities and schools could educational theories be tightly connected to practices. This university-school cooperation or partnership indicates a help-seeking process between both sides. On a basis of mutual interests, reciprocity, and symbioses, this cooperation process aims to improve teacher quality of both parties.

Ref. [6] identified three advantages of this university-school partnership: (1) Improving teachers' skills in professional dialogues, bridging the gap between theory and practice, and activating teacher learning communities; (2) Promoting university teachers a deep understanding about teaching practice in elementary and secondary schools, and helping school teachers make future plans about professional development; and (3) Connecting community resources effectively, providing multiple teaching materials for student learning, and expanding school teachers' abilities and perspectives of curriculum design. The university-school partnership was considered to have similar characteristic as a teacher learning community did, such as sharing a common goal, focusing on student learning effects, and developing mutual trust, support, and communication [22]. In this partnership, university professors should play the leading role in two aspects. The first is to lead the directions of team thinking by questioning the blind spots in curriculum design, and the second is to stimulate team members' new thinking and practice by bringing in external resources. [23] also assumed the "catalyst" role that university teachers should play to stimulate and lead conversations in teacher learning communities for deep inquiry about teaching, learning, and the substance of subject matter knowledge.

A case study revealed that university teachers' assistance

in nearby high school courses could scaffold teachers' professional development as well as transform the contradictory state of challenges and conflicts into a driving force of the teacher learning community [7]. Furthermore, constructive actions through negotiations and boundary-crossing collaboration in the community could expand areas of learning, and thus foster individual as well as collective professional growth. An empirical study with seven junior high school teachers in Taipei City indicated that the university-school partnership consisted of four phases: problem inquiry, schedule planning, dialogues and lesson observation, and feedback and reflection [25]. Although there existed problems in this partnership such as lack of time and facilities as well as teacher participants' insufficient understanding about the partnership activities, benefits were found to junior-high school teachers including introducing professional support, increasing teacher identity, improving teaching effectiveness, strengthening team collaboration, making both teachers and students learn from each other, opening a mind for professional dialogues, and sharing resources. Above all, the cooperation or partnership between universities and schools represents a friendly, trustworthy, and reciprocal relationship among professional partners in education. Furthermore, research has indicated that the teacher learning community base on this partnership would benefit professional growth in both parties. Senior teachers participating in such teacher learning community would be more likely to undergo a change. Such change was the main focus of this study.

III. METHOD

The case study method was used in this study to explore a senior teacher's change in a learning community, which aimed to improve pre-service teachers' teaching quality. Multiple data were collected including teaching materials, discussions in our learning community, reflections, classroom observation, and interviews.

A. The Setting

This study was conducted in one of the junior high schools in New Taipei City. Here, we called it the "Sunshine" school. Established more than 20 years ago, the Sunshine school originally had 13 classes and increased to more than 50 classes currently. There were 35 students in each class. Each classroom was equipped with a computer and a projector. Due to the school's location, we have a very close relationship with the Sunshine school. It had been our cooperating school since our center was established in 1995. For recent three years, the Sunshine school has been working with us in a project entitled "Improving the Quality of Teacher Candidates" granted by the Ministry of Education. A learning community, resulting in collaboration between the Sunshine school and our university, was thus built to increase future teachers' teaching skills and practices.

B. The Case and the Learning Community

The case of this study was a male teacher in the Sunshine junior high school. Here, we called the teacher "Mr. Su." Mr. Su graduated from the Department of Chinese, National

Kaohsiung Normal University, and has been teaching Chinese in Junior and Senior high schools for more than 32 years. He also got a master's degree in guidance. However, he did not have much experience with technology, not to mention using it in his class. Currently, Mr. Su was teaching Chinese in a 7th grade class and he was also a homeroom teacher of that class.

In addition to Mr. Su, the learning community in this study consisted of three pre-service teachers from the Department of Chinese of our university and three teacher educators from the Center for Teacher Education of our university. One of the teacher educators specialized in Chinese teaching and the others, authors of this paper, had many years of experience in teacher education.

C. The Procedure

This study was conducted in the school year of 2013. Below were activities our community performed in the fall semester.

- 1) At the first meeting, every participant in the community had a chance to know each other, and Mr. Su showed the Chinese textbook currently used by the 7th graders.
- 2) Mr. Su received an interview by the first author. The interview was about his educational background, his subject teaching belief and experience as well as his technology integration perception and experience.
- 3) At the second meeting, the tasks to be carried out in this semester were scheduled and confirmed.
- 4) Mr. Su's teaching was observed the first time for a period of 45 minutes in his classroom, followed by a discussion meeting. The lesson was *Over the Barriers of Time and Space*.
- 5) Mr. Su's teaching was observed the second time, followed by a discussion meeting. The lesson was *The Impression of Paper Ships*.
- 6) At the following two meetings, we prepared a lesson together. The lesson was *The Musician and the Basketball Star*.
- 7) Mr. Su's teaching was observed the third time, followed by a discussion meeting. The lesson was *The Musician and the Basketball Star*.
- 8) At the January meeting, the tasks to be carried out in the following semester were scheduled and confirmed.
- 9) Mr. Su was invited to write a reflection report at the end of the semester. The report had guiding questions such as the decision making process of his use of a video in the lesson, and its effects and implications.

Below were activities our community performed in the spring semester.

- 1) At the following three meetings, we prepared a lesson together. The lesson was *Children's belfry*.
- 2) One of the pre-service teachers implemented the lesson plan in Mr. Su's class, while the other community members observed his teaching, followed by a discussion meeting.
- 3) At the following three meetings, we prepared a lesson together. The lesson was *The Culture of Scorpions*.
- 4) Another pre-service teacher implemented the lesson plan in Mr. Su's class, while the other community members observed his teaching, followed by a discussion meeting.
- 5) Similarly, we prepared a lesson together at the following three meetings. The lesson was *Writing a poem on the*

Ground.

- 6) The third pre-service teacher implemented the lesson plan in Mr. Su's class, while the other community members observed his teaching, followed by a discussion meeting.
- 7) Mr. Su received a final interview by the first author at the end of the semester. The interview was mainly about what inspirations and perceptions he had on technology integration into instruction after a year of interaction and collaboration with the members of our community.

IV. RESULTS AND DISCUSSION

The results of our data analysis regarding Mr. Su's change are described in four parts as follows.

A. Change in Classroom Management

The first interview data revealed that Mr. Su placed great emphasis on the classroom rules and discipline. He managed to maintain students' attention by walking around in the classroom. Being more teacher-centered, Mr. Su favored didactic instruction, which allowed him to take control of the whole class easily.

Teachers don't usually set a boundary to what to teach in class when the time has come for affective teaching. If teachers have worksheets in hand, it would definitely block the teaching flow and make the teaching process more mechanistic. But if I apply a traditional way of teaching, I can adjust my teaching towards more affective aspects according to students' feedback at that moment. (Discussion, Nov. 19, 2013)

While Mr. Su had high expectations of students' attitudes, he had low expectations on students' comprehensive abilities and learning habits. He believed that students did not have sufficient abilities for self-learning or group discussion.

The academic performance of this class is ranked high among the 7th grade classes. For instance, their social science teacher said that the test average of this class was ranked top two among all the classes. And so do the other subjects. However, their performance in group discussion is not quite satisfactory. It's hard to imagine the outcomes of other classes in that circumstance. (Discussion, Dec. 17, 2013)

When Mr. Su implemented group discussions in his class, however, he showed a high tolerance of classroom disturbances and gave his students more freedom. This supports the argument that teaching practices affect teachers' original beliefs [14].

Students would just wait till the teacher gave them answers. It's difficult for them to think and solve the problems. They do not have such habits, either. When I witnessed that some students became relaxed in the class, I would be so upset and would scold them if it occurred previously. (Discussion, Nov. 19, 2013)

B. New Insights about Instructional Design

Though Mr. Su was not satisfied with the outcomes of collaborative learning, he gained some insights about its operations. He diligently downloaded a worksheet designed by a famous university professor from the Internet. He then applied the worksheet in his class. It turned out that "students have difficulty understanding the statement of the worksheet.

Consequently, they were not able to provide responses." (Discussion, Nov. 14, 2013)

When designing a worksheet, teachers should take students' abilities into consideration. Questions should be easier and more concrete so that students have sufficient abilities to submit responses. (Discussion, Nov. 4, 2013)

Furthermore, Mr. Su assumed that it is difficult for most students to prepare a lesson by themselves in advance. Therefore, he suggested that some measures that had been used effectively in remedial teaching could be taken.

You need to pay attention to student interaction, that is, whether or not they read out loud to each other. And correct them if they make mistakes. Only by doing these, self-learning can work. (Discussion, Nov. 4, 2013)

In view of the limited effects of group discussions, Mr. Su pointed out that the key for success might not lay in the worksheet questions but in the student's habit of discussing with others.

It's difficult to implement group discussions in class with various academic levels of students mixed in a group. Moreover, students might lack discussing habits, have no willingness to discuss, or have no ideas to be discussed. (Discussion, Dec. 17, 2013)

Through brainstorming in our learning community, Mr. Su suggested that most videos with dramatic stories and narratives were suitable for today's students.

The design of questions should be relevant to students' personal life or experience in order to motivate them to participate in group discussions. Students have more difficulties to understand the content of a textbook than that of a video. And using videos is more likely to stimulate students' imagination. (Discussion, Nov. 19, 2013)

C. Change in Perception of Technology Integration

Previously, Mr. Su simply considered that using technology was detrimental to classroom management.

When you play a video, the lights in the classroom would be turned off. And we don't know what students are doing. Therefore, it's difficult for teachers to control the classroom order and students' concentration. (Interview, Oct. 8, 2013)

Mr. Su did not even use a microphone in his class mainly because "he can identify if there are some voices and where they are coming from. Hence, he can take control of any misbehavior." (Interview, Oct 8, 2013) He further expressed his attitudes towards technology use in Chinese teaching.

Note taking is a key element for Chinese learning. It is really easy to use textbook, blackboard, lectures and so on. Textbooks and paper cannot be replaced. Pictures and videos could only serve as a supplement to textbooks. (Interview, Oct. 8, 2013)

In spite of Mr. Su's negative attitude towards technology use, he still urged future teachers to integrate technology into their instruction. Perhaps to set a good example for the pre-service teachers in our community, Mr. Su voluntarily used two videos provided by the publisher at his second teaching demonstration. As a result, he highly recognized its learning effect. So when we prepared the next lesson together, he strongly suggested a web search of relevant videos for the lesson. From then on, Mr. Su frequently examined the video discs provided by the publisher. Therefore, when the third

pre-service teacher ended her teaching demonstration twenty minutes earlier unexpectedly, Mr. Su took over the class immediately. He calmly played a video provided by the publisher and then gave a detailed explanation about its plot to the whole class. It seemed that Mr. Su had been prepared in advance for showing this video. It was really impressive.

In summary, Mr. Su's perception of technology integration became more positive after he enthusiastically accessed to technology and actually applied technology in his classroom. This finding is consistent with previous research that personal experience of technology integration highly affects teachers' beliefs and commitments of technology [13]. Furthermore, strongly supported by the whole community as well as successful experience in technology use, Mr. Su exhibited more confidence in technology use and displayed a high motivation to experiment it in his class [16], [18].

D. Advance in Technical Proficiency

Mr. Su explained his decision to use two videos provided by the publisher at his second teaching demonstration of the lesson: *The Impression of Paper Ships*.

The first video introduces children's toys in old times and then demonstrates how to make paper ships. Because today's students lack such experience in their childhood, the video could visualize the objects of old times. Every student is given a piece of paper. Students follow the steps presented by the video to make paper ships in person. In this way, students might be able to sense the special old-time atmosphere that the writer described in the text. The second video is about the writer's life story. The writer was best known for his novels. Unfortunately, he passed away at an early age. The video contains comprehensive documents and high-quality images. After watching the video, students could get an overall picture about the writer. (Reflection, Feb.10, 2014)

Mr. Su then described the effects of using these two videos.

Students followed the steps presented by the video to make paper ships. Because these steps were simple and clear, most students successfully completed the task at the end. Although they were not so excited, they looked happy due to making paper ships with their own hands. Many junior high school students like activities at this age. Furthermore, object operations could somewhat alleviate the pressure of academic loadings. Compared with the teacher's demonstration, the object's size is small and students might have a hard time observing each step clearly. Therefore, it is not suitable for simple operations, let alone more complex ones. Under this circumstance, technology has its strengths in terms of convenience and effectiveness (Reflection, Feb 10, 2014)

Mr. Su further used two videos provided by the pre-service teachers in the lesson: *The Musician and the Basketball Star*. His decisions and reflections are described as follows.

More videos could be found in the Internet for such a basketball star as Michael Jordan. The clarity of the video should be considered the most important. A second consideration is the length of the video. Using the video is to motivate students because the image catches attractions. By editing and producing, technology can precisely reveal consummate skill or mastery in basketballs. (Reflection, Feb 10, 2014)

In summary, Mr. Su's development of technology integration has moved from the entry stage to the adoption stage. His focus was still on the functions of technology, and the technology he commonly used was confined to videos. Mr. Su appeared to be a type I user according to Maddux and Johnson's classification [26]. The aim of technology use is to make traditional learning and teaching more convenient and efficient. His pedagogical talents based on years of teaching experiences seemed to have a weak contribution to his implementation of technology integration. On the contrary, Mr. Su's ingrained preference for teacher-centered instruction might constrain his creative use of technology, and hence hinder his progress towards higher stages of integration [27].

V. CONCLUSION

In this study, we explored a senior teacher's change in a learning community built on a partnership between our university and the junior high school for improving the quality of pre-service teachers. Based on the data collected through the whole academic year, the senior teacher appeared to have growth in class management, instructional design, perception of technology integration, and technology proficiency. Furthermore, the senior teacher became used to implementing technology integration in his class. This indicates that sufficient technology support from teacher learning communities increase senior teachers' willingness and confidence in technology integration in their classes. Under such circumstances, senior teachers are more likely to have successful experiences which in turn inspire them to experiment more about technology integration. In summary, teacher learning communities strongly benefit senior teachers' professional development in technology integration.

This study also revealed that senior teachers' ingrained preference for teacher-centered instruction might constrain their creative use of technology. Therefore, we suggest that university teachers play a more active role in helping senior teachers progress towards a higher level of integration. For instance, senior teachers' visions of technology integration could be enriched by introducing various emerging technologies that senior teachers could easily access to, and by providing practical teaching examples of multiple and creative use of technology in the classroom. Finally, it is very important to engage senior teachers in collective inquiry into the substance of teaching and learning for a possible shift towards more student-centered approaches. In fact, senior teachers have an enormous influence on their colleagues. Although more challenges need to be dealt with, senior teachers' professional development in technology integration should not be skipped and overlooked.

REFERENCES

- [1] M. S. Garet, A. C. Porter, L. Desimone, B. F. Birman, and K. S. Yoon, "What makes professional development effective? Results from a national sample of teachers," *American Educational Research Journal*, vol. 38, no. 4, pp. 915-945, December 2001.
- [2] S. J. Chang, C. C. Wang, and L. Y. Feng, "Teacher professional learning communities for elementary and secondary schools," *Teachers' Chamber*, vol. 169, pp. 20-26, December, 2010.

- [3] P. C. Kao, "Problems and solutions on the development of teacher communities," *Journal of Education Research*, vol. 201, pp. 39-48, January 2011.
- [4] W. K. Wang, "Cultivating communities of practice for curriculum development and teacher professional development," *Journal of Curriculum Studies*, vol. 2, no. 2, pp. 41-63, March 2007.
- [5] S. L. Wang and H. W. Kang, "The current state and trend of the development of teacher professional learning communities at junior high schools," *Journal of Education Research*, vol. 215, pp. 17-29, March 2012.
- [6] S. J. Chang and P. Y. Yen, "The research on the concept and implementation of partnership program between college and junior high/ elementary school teachers: Take the curriculum reform in Taiwan as example," *Journal of Educational Research and Development*, vol. 5, no. 1, pp. 91-130, March 2009.
- [7] S. J. Chang, C. C. Wang, and L. Y. Feng, "Teacher professional learning communities for elementary and secondary schools," *Teachers' Chamber*, vol. 169, pp. 20-26, December, 2010.
- [8] Y. H. Lai, "A meta-analysis on the effects of computer-assisted instruction on students' learning achievement in Taiwan," *International Journal of Computer and Information Technology*, vol. 3, no. 2, pp. 292-298, March 2014.
- [9] S. Bayraktar, "A meta-analysis of the effectiveness of computer-assisted instruction in science education," *Journal of Research on Technology in Education*, vol. 34, no. 2, pp. 173-188, April, 2001.
- [10] B. Backhouse, "Information and communication technology integration: Beyond the early adopters," *TechTrends*, vol. 47, no. 3, pp. 5-8, May 2003.
- [11] G. Russel, G. Finger, and N. Russel, "Information technology skills of Australian teachers: Implications for teacher education," *Journal of Information Technology for Teacher Education*, vol. 9, no. 2, pp. 149-166, December 2006.
- [12] W. J. Pelgrum, "Obstacles to the integration of ICT in education: Results from a worldwide educational assessment," *Computers and Education*, vol. 37, no. 2, pp. 163-178, September 2001.
- [13] Y. F. Chang, "Two cases of integrating computers into the English Curriculum," *Educational Research and Information*, vol. 9, no. 5, pp. 129-148, October 2001.
- [14] T. R. Guskey, "Professional development and teacher change," *Teachers and Teaching: Theory and Practice*, vol. 8, no. 3, pp. 381-391, August 2002.
- [15] Y. Zhao and K. A. Frank, "Factors affecting technology uses in schools: An ecological perspective," *American Educational Research Journal*, vol. 40, no. 4, pp. 807-840, October 2003.
- [16] J. H. Sandholtz, C. Ringstaff, and D. C. Dwyer, *Teaching with Technology: Creating Student-Centered Classrooms*, New York: Teachers College Press, 1997.
- [17] Y. H. Chen and S. J. Jang, "Interrelationship between stages of concern and technological, pedagogical, and content knowledge: A study on Taiwanese senior high school in-service teachers," *Computers in Human Behavior*, vol. 32, pp. 79-91, March, 2014.
- [18] H. C. Tsai, "A senior teacher's implementation of technology integration," *International Education Studies*, vol. 8, no. 6, pp. 151-161, May 2015.
- [19] S. M. (Ed.) Hord, *Learning together, leading together: Changing schools through professional learning communities*; New York: Teachers College Press, 2004.
- [20] L. Stoll, R. Bolam, A. McMahon, M. Wallace, and S. Thomas, "Professional learning communities: A review of the literature," *Journal of Educational Change*, vol. 7, no. 4, pp. 221-258, December 2006.
- [21] J. B. Huffman and K. K. Hipp, *Reculturing Schools As Professional Learning Communities*, Lanham, MD: Scarecrow Education, 2003.
- [22] S. C. Chang and C. H. Wu, "A case study on the professional partnership between university and school: Focusing on the professional learning community," *Journal of Educational Research and Development*, vol. 8, no. 1, pp. 1-30, August 2012.
- [23] W. M. Roth, K. Tobin, C. Carambo, and C. Dalland, "Coteaching: Creating resources for learning and learning to teach chemistry in urban high schools," *Journal of Research in Science Teaching*, vol. 41, no. 9, pp. 882-904, October 2004.
- [24] J. J. Wang and H. W. Wong, "Collaborative curriculum development and teacher professional development. Hin Wah Wong & Hung Fan Sing," *Collaborative Partnerships in Curriculum Development and Teacher Professional Development*, pp. 1-17, July 2003.
- [25] Y. K. Ting, "The study of process and effect of the implementation on the school-university partnership," *Journal of Teacher Education and Professional Development*, vol. 4, no. 2, pp. 45-65, December 2011.
- [26] C. D. Maddux and D. L. Johnson, "Type II applications of information technology in education: The next revolution," *Computers in the Schools*, vol. 23, no. 1/2, pp. 1-5, October 2006.
- [27] P. A. Ertmer, "Addressing first- and second-order barriers to change: Strategies for technology integration," *Educational Technology Research and Development*, vol. 47, no. 4, pp. 47-61, December 1999.



Ya-Fung Chang was born in Taichung, Taiwan. She obtained a bachelor of education from National Taiwan Normal University, Taiwan. Then she taught English in a junior high school. Two years later, she went to America for graduate study. She obtained a master's degree in educational technology from University of Northern Colorado, U.S.A. in 1984, and a Ph. D. in secondary education from University of Illinois (Champaign-Urbana), U.S.A. in 1987.

She is currently a professor at the Center for Teacher Education at Tamkang University, New Taipei City, Taiwan. She has been working at the center for more than twenty years. The courses she teaches are Instructional Media and Applications, Curriculum Development and Design, and so on. She was the director of the center from 2000 to 2004. She published many articles related to technology integration in teacher education.



Chia-ling Hsu was born in Taipei, Taiwan. She graduated from Soochow University, Taipei, Taiwan. She obtained a master's degree in computer education from Columbia University, U.S.A. in 1983, and a Ph. D. in curriculum and instructional design from Missouri University U.S.A. in 1993. She is currently an associate professor and the director of the Center for Teacher Education at Tamkang University, New Taipei City, Taiwan. The courses she teaches are Instructional Media and Applications, Instructional Theories, and so on. She published many articles related to instructional design and E-learning.