

# The Research on Cultivating Vocational School Teachers' Educational Research Ability in a Knowledge Building Community

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**Abstract:** The novice teachers from vocational schools are normally short of educational research ability, which is the basic requirement of teachers' professional development. However, these abilities are always inhibited by traditional lecture-centered training mode. This research organized a Knowledge Building community for 42 novice vocational school teachers who are from 19 vocational schools in Nanjing, China. The KB journey started from their own authentic problems happened in their 1 or 2-year teaching experience, supported by the community meeting, knowledge building circle, knowledge building poster session and research paper discussion, after which the novice teachers raised diversity ideas and theory building of teaching and learning. Data source is from their notes on Knowledge Forum, research papers and feedback forms as well as the interview records. Content analysis and open coding are main methods. The research results indicated that these novice teachers have strong potential to do educational research and have a strong sense of teaching reflection and problem discovery, as well as deep thinking. However, due to objective conditions and teachers' own limitations, they still need to strengthen their abilities in data processing and overall planning.

## Introduction

Educational research ability is the ability that teachers can solve problems in educational context effectively and they can study on students, curriculum, teaching objectives, teaching process, teaching methods, teaching strategies, teaching environment and so on (Yang, 2012). Numbers of researchers have pointed out that educational research is an inevitable choice for a professional teacher (Christie, 2006), which means that an excellent teacher not only should have abundant of teaching knowledge and skills, but also should have deep thinking ability and they are supposed to discover, analyze and solve problems. However, existing studies have shown that current teacher training still focus on teaching pedagogical theories, methods (Chang, Fang, et al, 2009). Moreover, lecture is the most widely adopted way to train teachers, which is less effective for teachers and probably lead to a decrease in teachers' participation, then miss the opportunity to foster their educational research ability. The problems are as followed that teacher training has lasted for decades, but traditional training beliefs, content and methods are still stay unchangeable. Whether this training beliefs can meet with the demands of present society?

Knowledge Building, defined as "the production and continual improvement of ideas of value to a community" (Scardamalia & Bereiter, 2003), which is a knowledge innovation theory and also a new teaching belief, trying to cultivate teachers' research ability. In the past few decades, Knowledge Building theory has guided a great variety of teacher training programs in many countries (Hung, Hong et al, 2017; Lin, Hong, et al, 2019). Researches showed that it can help foster teachers' sense of innovation and design thinking, but whether it can promote teachers' educational research ability remained unknown.

Vocational school teacher training program is organized every year in Nanjing, China, while the effect is unsatisfying. Because traditional teacher training which highlighted teaching knowledge may not enough, at least for those novice vocational school teachers, they just get some teaching theory and experts' knowledge and they did not have their own research ability. So this research will help 42 novice teachers in 19 vocational schools, who have been working for 1 or 2 years to build a knowledge building community and start teacher training. Three research questions will be focused on:

1. What the vocational teachers' research ability is after the teaching training program based on Knowledge Building?
2. How did these vocational teachers change their research ability in the training?
3. What is the main reason for them to make changes in educational research ability?

## Methodology

### Research Context and Participants

This research is actually a teacher training program for novice vocational school teachers in Nanjing, which has totally 19 vocational schools, 42 novice teachers from 35 subject areas involved. The teachers all have a few

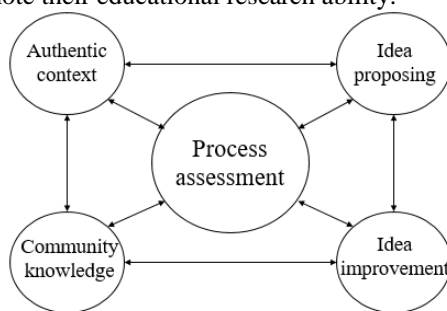
teaching experiences, with 37 teachers start teaching in the year of 2019, and the other 5 teachers start teaching in 2018. 17 of them has got master degree while the other has got bachelor degree. The average age is about 26 years old. They are used to traditional teaching training before this program, they have never heard of Knowledge Building and they are not used to construct their own knowledge.

The main purpose of this training is to promote the professional development of vocational teachers, which was lasted for approximately 3 months. The training has 2.5-hour offline class every two weeks. The training guidance group is constituted of a main trainer who is an expert in Knowledge Building, studying Knowledge Building for decades; an experienced organizer who organize vocational teacher training program every year; And 4 assistants whose main duty is to observe the whole training process and feedback, as well as collecting training data.

The overall environment is relaxing and flexible, with teachers can move around freely in class, form and disband groups, participating discussions as they wish. Each teacher is required to have a laptop to join the online discussion on Knowledge Forum at any time. The trainer encourage teachers to keep their ideas on KF, so as to visualize their inner ideas.

### KB Training Process

The whole training process is based on Knowledge Building and its 12 principles. During the offline training session, the experienced trainer adjust his training in time according to teachers' behavior and based on a teaching procedure mode (figure 1), trying to make teachers find problems, start deep thinking and participate in the training actively, which help to promote their educational research ability.



**Figure 1.** A KB-based Teaching Procedure Mode

The whole training was divided into 3 phases. In the phase 1, the trainer organized a series of activities, like each teacher needed to talk about their confusion about teaching. For instance, “are the teaching strategies reasonable nowadays? What is the nature of teaching and learning? Is there a conflict between teaching theory and practice?” they just come up with a great variety of interesting teaching problems and they were required to post notes on Knowledge Forum and have offline discussions. The trainer seized the opportunity to discuss about how to demonstrate ideas. Therefore, teachers' discussion started transforming from shallow construction to deep construction.

In the phase 2, it was obvious that teachers were stuck in a situation that they just described what the problem is and they cannot find out ways to solve it, which make the development of teachers' research ability stay still. Thus, the trainer have a deep discourse with all the teachers in a meta-cognition level about how should we do the research, how can we understand others and give others reasonable suggestions on Knowledge Forum, after which we also provide numbers of scaffoldings, like “what I have known about the existing theory related to the problems; I think this theory cannot explain...” Finally those scaffoldings help teachers to transform their abstract expressions into concrete expressions. In addition, the trainer also introduce some excellent teaching cases in order to widen teachers thinking. The teaching theory of ADDIE (Analyze, Design, Development, Implement, Evaluate) was taught by the trainer and poster sessions were organized to foster the interaction (figure 2).



Figure 2. Teachers' artifacts in poster sessions

In phase 3, we all hoped to further promote teachers' educational research ability by asking teachers to reflect on their own research questions in the community. So several poster sessions were held and in the sixth offline class, we organized the Knowledge Building circle to discuss teachers' research paper. So all the teachers were set in four groups and propose their ideas and have Knowledge Building discussion, after which write down the group reflection. In the seventh offline class, teachers all finished their research paper and have the whole class meeting to talk about their study.

### Data Collection and Analysis

The educational research ability include the awareness of teaching problems; analysis of teaching problems; and problem solving ability. The data source is KF notes, teachers' research papers and their feedback forms.

1. The dimension of process: using content analysis to analyze teachers' KF notes

There are totally 6 views on KF, namely Analysis, Design, Development, Implement, Evaluation and Others.

Table 1: Contributions in each view

View	Analysis	Design	Development	Implement	Evaluation	Others	Total
The number of notes	92	52	1	37	10	123	315

In order to evaluate teachers' educational research ability, this research use and modify a coding scheme to represent educational research ability (table 2) and do the content analysis based on 315 notes. In order to make sure the validity, two raters had independent analysis, and Cohen' Kappa is 0.86, which means the result has good validity.

Table 2: Coding scheme to evaluate teachers' educational research ability

Categories	Sub-categories		Coding
Awareness of teaching problems based on practical reflection	Reflect on teaching activities, realize the advantages and disadvantages and find out the teaching problems.		A1
	Analyze the difficulty, feasibility and research value of the teaching problems.		A2
	Summarize and rise above the teaching problems into a clear research topic.		A3
Analysis of teaching problems based on rational understanding	Find helpful, authoritative and up-to-date materials through multiple ways.		B1
	Classify and summarize research materials.		B2
	Think critically about existing research about problems and extract effective and critical information.		B3
Problem solving based on systematical logic framework	Ability to use research methods	Select the appropriate research methods according to the characteristics of the research problem	C1
		Combine various research methods together according to research needs	C2
	Ability to design research proposals	Design the whole research framework based on the selected research methods	D1
		Design concrete implementation steps based on research ideas	D2
		Reflect on the research plan and make adjustment and modification	D3
	Ability to process data	Collect data related to the implementation process in time	
		Filter the collected data, identify and classify the valid data, and	

		understand the functions of different data	
		Analyze data using words, figures, graphics, etc	
		Dig out effective data and summarize the reasons and nature behind the phenomenon	
	Ability to express and reflect on research findings	Analyze the research results, using teaching theories to demonstrate the research conclusions	
		Express the findings in a understandable way	
		Reflect on the research results and transform them into specific teaching strategies	

2. The dimension of training outcomes: using content analysis to analyze teachers' research paper

In this training program, each participant was required to submit a research paper. 36 valid research paper were collected at the end of this training, excluding 4 papers that were unrelated to the theme. In order to make a summative evaluation of teachers' educational research ability from the perspective of final outcomes, the research used the analysis scale shown in table 2 above. Each category has five grades, namely 1-5, and these 36 papers were then scored by two researchers to ensure the validity of the final grades.

3. The dimension of explanation: using open coding to code teachers' feedback forms

In order to analyze the reasons why teachers' research ability has changed, this research try to have collective reflection session and individual interview at the end of the training to dig out deeply about the reason. The collective reflection was carried out in Knowledge Building circle which has already mentioned and 32 valid reflection records.

After the sixth offline training, semi-structured interviews were organized. 7 teachers who are typical in class performance were picked to be asked several questions that based on interview outline. The whole process of interviews were recorded which has approved by these teachers and transcript them into text. The reason to pick up these 7 teachers is that 2 of them had active attitude all the time and finish all the tasks as they could; 3 of them perform in an average level and the number of their notes on KF were in an average level as well; while the other 2 of them were not active and they always leave the training early.

As for the interview data and reflection documents, this research try to use Nvivo software to code all the information. The brief of coding is to read all the data and create nodes as needed and merge as well as group these nodes into related categories. Two researchers were participated in the open coding work.

## Results

1. From the dimension of training process, teachers have deep inquiry while still lack of overall planning ability

This research analyzed 315 notes excluding 87 notes that were unrelated to educational research ability using the coding scheme shown in table 2. The analyzed results are in table 3. It is found that during Knowledge Building discussion, teachers reflected more on current teaching activities (totally 72 notes) and they can critically think about the information (totally 71 notes). All these data indicated that the teachers were buried themselves in active learning and researching, they were thinking deeply about the advantages and disadvantages of teaching, which has already seems to be different from what they performed before. But from table 4, the notes that are about overall planning and proposal designing are still a few, which can be inferred that teachers are still lack of the ability to combine different teaching strategies.

Table 3: The numbers of notes in three different dimensions

Awareness of teaching problems			Analysis of teaching problems			Problem solving				
Reflect on teaching activities to find problems	Analyze the difficulty and value of the problem	Summarize the topic of the study	Find information in multiple ways	Classify and summarize research materials.	Critically select useful information	Strategies applying		Proposal designing		
						Choose appropriate teaching approaches	Combine multiple approaches	Design overall framework	Design specific steps	Reflect and modify the proposal
72	20	22	33	10	41	20	3	4	2	1

In addition, notes in different views in three phases were collected and compared. Figure 3 showed the results. Research found out that as training going on, the percentage of notes that are about reflection and analysis about the difficulty of a teaching problem is reduced gradually, while the percentage of notes that concentrated on analyzing and solving problems rise rapidly, especially in the third phase, the percentage of analyzing reached 50%.

The percentage of notes about problem solving has also risen from 5% to 20%, which indicate that teachers propose numbers of problem in the first phase, while in the second and third phase, they were investigating and thinking to further their research. Thus, it can be inferred that they have really buried in educational research.

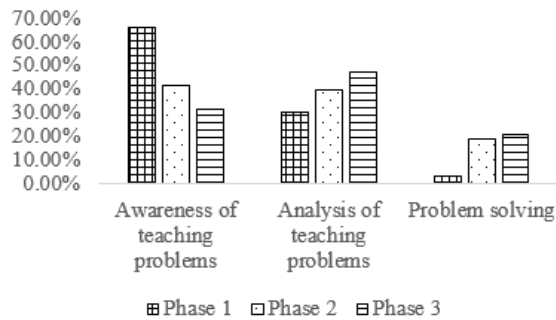


Figure 3. Percentage of notes in three different phases

2. From the dimension of training outcomes, teachers have strong sense of discovering teaching problems

The score of teachers' final research paper were assessed by several researchers based on table 2. So the final result is showed in table 4, which indicated the final result of teachers' educational research ability.

It is found out that teachers have the highest score on reflecting and summarizing topics (around 3.3). They were thinking deeply when finish their research paper. But teachers performed not so well in other aspects especially on data processing, which refers that except to provide them free research environment to enhance their problem awareness and analytical ability, the techniques and methods of data processing are also needed to promote their educational research ability.

Table 4. The score of teachers' research paper

			Average Score	Standard deviation
Awareness of teaching problems		Reflect on teaching activities to find problems	3.33	1.10
		Analyze the difficulty and value of the problem	3.00	1.15
		Summarize the topic of the study	3.31	1.17
Analysis of teaching problems		Find information in multiple ways	2.47	1.03
		Classify and summarize research materials.	2.28	1.00
		Critically select useful information	2.17	1.03
Problem solving	Strategies applying	Choose appropriate teaching approaches	2.47	1.08
		Combine multiple approaches	1.94	0.98
	Proposal designing	Design overall frame-work	2.31	0.86
		Design specific steps	2.31	0.95
		Reflect and modify the proposal	1.89	0.89
	Data processing	Collect data related to the implementation process in time	2.08	1.16
		Filter the collected data, identify and classify the valid data	1.92	1.05
		Analyze data using words, figures, graphics, etc	1.81	0.92
		Dig out effective data and summarize the reasons and nature behind the phenomenon	2.11	0.98
	Express and reflect on research findings	Analyze the research results, using teaching theories to demonstrate the research conclusions	2.28	0.85
Express the findings in a understandable way		2.53	0.77	

		Reflect on the research results and transform them into specific teaching strategies	2.28	0.94
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3. From the dimension of explaining, Knowledge Building can help teachers foster their educational research ability because of its atmosphere and beliefs

From the perspective of process and outcomes, it is clear that teachers' thinking ability has improved greatly, while they are still deficient in detailed research process. In order to find out the reasons, the collective reflection documents and interview records were analyzed via Nvivo software and did open coding work by researchers. The final result is in table 5.

Table 5. The coding results of the reason teachers' changing research ability

Parent node	Child node	Child node
advantages	Training mode (21)	High engagement (3); Continue to think (1); Guidance by trainer (8); Thinking deeply (6); organizing thoughts (1); Potentialities exploiting (1); More ideas (1)
	Peer pressure and help (14)	Different opinions (10); Reflect on others' ideas (1); Conclude others' ideas(1); Peer inspiration (1); Supplement with peers (1)
	Individual factors (2)	Self-efforts (1); Self-study about teaching theory (1)
limitation	Approaches (5)	Lack of quantitative approaches (4); Difficulty in finding literature (1)
	Difficulty in relating practice (11)	Difficulty in the teaching content (1); Theory cannot relate to practice (2); Hard to popularize (1); Hard to deeply improve (1); Difficulty in activate students (6)
	Objective condition (23)	Lack of partners (2); Lack of resources (5); Limitation in the training duration (2); Lack of data (9); Limitation in subjects (2); Teaching pressure (3)
	Self - imitation (15)	Have little knowledge of teaching (2); Lack of time (7); Lack of confidence (3); Have no awareness of reading literatures (1); Lack of teaching experience (2)

Note: the number in brackets mean the number of nodes

The research found out that teachers thought Knowledge Building has increased their participation of training (3 nodes). They believe that under such atmosphere can they think deeper about teaching problems (6 nodes) and get different opinion from other teachers and help each other (14 nodes) to improve their educational research ability. Therefore, KB-based teacher training can gradually help teachers to absorb in researching because of a unique research atmosphere and its strategies.

On the other hand, there still exist numbers of limitation. It is found out that teachers did not have a good command of overall planning, literature reading, data processing and paper writing ability. Because teachers have a little understand of some theoretical methods, like they know a little about the quantitative approaches (4 nodes); the students are hard to handle (6 nodes) and their own limitation (15 nodes) as well as some objective condition, which make it difficult to balance the research and their teaching.

## Conclusion and Discussion

This research try to improve vocational school teachers' educational research ability in Knowledge Building community. Thus, a three-phase Knowledge Building training mode was designed to make teachers absorb in a researching atmosphere that is good for them to raise and reflect on educational problem and increase the interaction among teachers to support deep thinking and discuss reasonable research plan and teaching strategies, which is an innovative attempt that is quite different from the traditional lecture-centered teacher training.

This research analyze the reason why teachers have changed on educational research ability and evaluate the effect of this training from three aspects of process, outcomes and explanation. It is found out that there are challenges and chances in this KB-based teacher training attempt. As for the chances, Knowledge Building can do increase the participation and provide them possibilities to think and develop. While as for the challenges, this training program did not realize the self-limitation of teachers and some objective condition, which means that in the

future study, an investigation toward teachers' background needs to be carried out. Moreover, a reasonable duration for the training program is also needed in order to overcome some objective problem.

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