# A Proposed Model of Teacher Researcher's Network to Create Instructional Innovation for Raising Students' Learning Achievement in Science and Mathematics

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## Abstract

The main objective of this article is to develop a model of teacher researcher's network to create instructional innovation for raising students' learning achievement in science and mathematics at the secondary education level. The research followed the research and development methodology as the followings; phase 1: preparing the collaborative strategies for supporting the teacher researcher's network, phase 2: developing the teacher researcher's network, phase 3: evaluating the quality of the teacher researcher's network and phase 4: disseminating and extending the teacher researcher's network participation. The target groups were classified into 3 groups as follows: 1) The 110 teachers from the learning substance of mathematics, science, physics, chemistry and biology in secondary education schools and 2) 5 educational supervisors and 3) 6 lecturers as researcher team from education faculty, 3 lecturers from science faculty. This research is currently in phase 2. The results revealed that, in area-based context, there were five major science and mathematics-related projects which represented the importance and value of the learning activity. The model of teacher researcher's network was developed and consisted of 5 important processes as follows: 1) the paradigm shift of teacher's perceptions toward the classroom action research 2) the situation analysis to delegate responsibility to work together as a learning community network, 3) both the innovation of teaching and the classroom action research to raise students learning achievement was considered as a collaborative and mutual responsibility of teachers 4) the monitoring, evaluating and reviewing and 5) sharing and reviewing the work to develop.

Keywords: teacher researcher, teacher researcher's network, instructional innovation

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**Introduction**
During the Eleventh Plan (2012-2016), Thailand will encounter more complicated domestic and external changes, and fluctuations that will present both opportunities for and threats to national development. Thus, it is necessary to utilize the current resilience of Thai society and its economy, and prepare both individuals and society as a whole to cope with the effects of such changes and pave the way toward well-balanced development under the Philosophy of Sufficiency Economy. In terms of development strategies, Thailand will promote a peaceful society with the growth of quality and sustainability. In dealing with rapid changes and complicated and unpredictable environmental events, a set of development strategies will be formulated for better risk management and to create a firm foundation for development. In addition, the quality of human capital will be developed through better access to resources and fair distribution of development benefits. To create and utilize economic opportunities, knowledge, technology and creativity will be crucial factors for environmentally friendly production and consumption leading to sustainable development. Key development strategies especially in the second strategy: developing a lifelong learning society; development guidelines including develop human resources aimed at increasing resilience to deal with changes. The ability of Thais at all ages should be increased. Skills for lifelong learning should be developed by focusing on knowledge, innovation, and creativity, and based on the development of five types of mind — the disciplined mind, the synthesized mind, the creative mind, the respectful mind and the ethical mind — in order to be capable of working in various positions relevant to the changing labor market over a lifetime. Values should be instilled in people for social responsibility, and respect for laws and human rights, as well as for environmentally friendly production and consumption. Citizens should learn to cope in appropriate ways with climate change and disasters. (Office of the National Economic and Social Development Board, 2012, p. 23)

The quality of education and factors related to international recommendations and the quality of education in science and mathematics can be summarized as follows: the quality of education in the country which was assessed by a national evaluation and the national institute of educational testing service such as NT, O-NET, A-NET, B-NET etc. In addition, the evaluation of the ability of students in science, mathematics and reading at international level such as TIMSS from year 1995 to 2007 and PISA from year 2000 to 2006 reflect the quality of Thai students which tended to decrease in all areas and in all those years. The Thai Education Ministry evaluated the ability of students in science and mathematics subject in the country with the leading countries in the region, Thailand have found that students had demonstrated very low academic achievements both in science and mathematics subject especially in secondary education levels. Evaluation of the student's ability both Thailand are also lower than the international average which should be developed urgently. (Educational Testing Bureau, 2009, p.1)

Education in the 21st century will have to prepare learners to develop the knowledge and skills necessary to think, learn to solve problems, communicate and collaborate more effectively. Factors related to such matters include teachers in the institution. This is because the education system will be whether successful or not. It is significantly dependent on teachers. (Bellanca & Brandt, 2010) This is consistent with Cochran-Smith (2006 cited in Shroyer, Yahnke, Bennett, & Dunn, 2007) who points out that the quality of teachers is a key factor affecting the success of the students as well as to

raise the quality of education. It is therefore obvious that the quality of teachers is a key component of education. It is necessary and urgent problems that must be resolved in order to raise the quality of national education. The research concerning the study of the problems of classroom action research of teachers was revealed that Thai teachers have been trained to do research in class as a part of their teaching routine but the achievement in the classroom action research, the quality of research and the value of such research, the idea of returning teachers were in moderate level, due to teachers lack of motivation and knowledge to do research in class. (Suksunai, Wiratchai & Khemmani, 2011, p. 2)

To raise the quality of education mentioned above, one factor which is particularly important in the implementation of successful educational reform is the quality of teachers. Improving the quality of teachers who facilitate the students' learning is therefore necessary to give priority to drive to achieve quality output to society. Teachers with skills in various areas need the ability to conduct the research. This is a skill that teachers use to find answers to problems about teaching, improve teaching, research and development work leading to the development of the students. Teachers should have skills in research, especially research to develop innovative teaching to raise student achievement in science and mathematics. The quality and youth meet the educational needs of the country are geared towards competition.

Operating in a network and dealing with a process that generates the power, Faculty of Education, Naresuan University as a leading teacher education faculty and producer of educational research network of the National Research Council should take responsibility as a hub of educational research and development network, teachers, researchers in innovative teaching to raise student achievement in science and math education using participatory research process to induce learning together. The establishment of a network of teachers, researchers will be innovative teacher. Professional development of teacher, therefore, is very important because it has helped to drive the sustainable development for quality education, the power to drive education reform. Fellow teacher researchers are thinking and co-operation, and being encouraged to do research. The sharing of resources and experience to do the research is linked to the mission, with the goal to aim at the quality of the students. This will enable teacher researchers see the importance and benefits of the research and inspired in the research process used in the development, management practices and continuous learning.

The researchers are aware of and appreciate the importance of raising the standard of education and the role of development, learning to drive a successful policy of education reform in the second century. It intends to develop a network of teacher researchers. The guidelines for the development of teacher researchers differed from the original context that is characterized by direct coordination network between researchers, teachers and others involved in the same province and a process that is connected to the area of study more when the project ends, it ends up no event coordinator for the network. The researchers then determined from the context of the learning process for teachers in the area. The manners in which the relative performance characteristics coupled together, learn the two districts that are the hallmark of quality student achievement science and mathematics are different form each other. The districts are the basis of a network to improve the quality of education and higher education institutions. The university's role as an agencies, including the

board of education, the agency also supports is the faculty of science, the districts include the secondary educational service area office 39 and 42, both districts to voluntarily participate in the program. The development process is focused on the development process by creating the coaching and mentoring system. As one of the key techniques that will enhance the learning of personnel to staff the learning will be crucial to the success and benefit the organization and its staff in working to achieve the goal to a professional learning community in a network of researcher teachers develop instructional innovation to solve low science and mathematics learning achievement.

**State of the Art**
This research article presents assumptions and research concerning; the constructivist theory that the focus is on the students who create the knowledge themselves.

The idea that education leaders in new leadership should be creative and productive; the development of human resources has been developed and accumulated knowledge in various areas, including innovation as strategic and organizational goals, to bring new ideas into practical use or modernization practices that lead to effective solutions for developers to create chances, in order to gain competitive advantage.
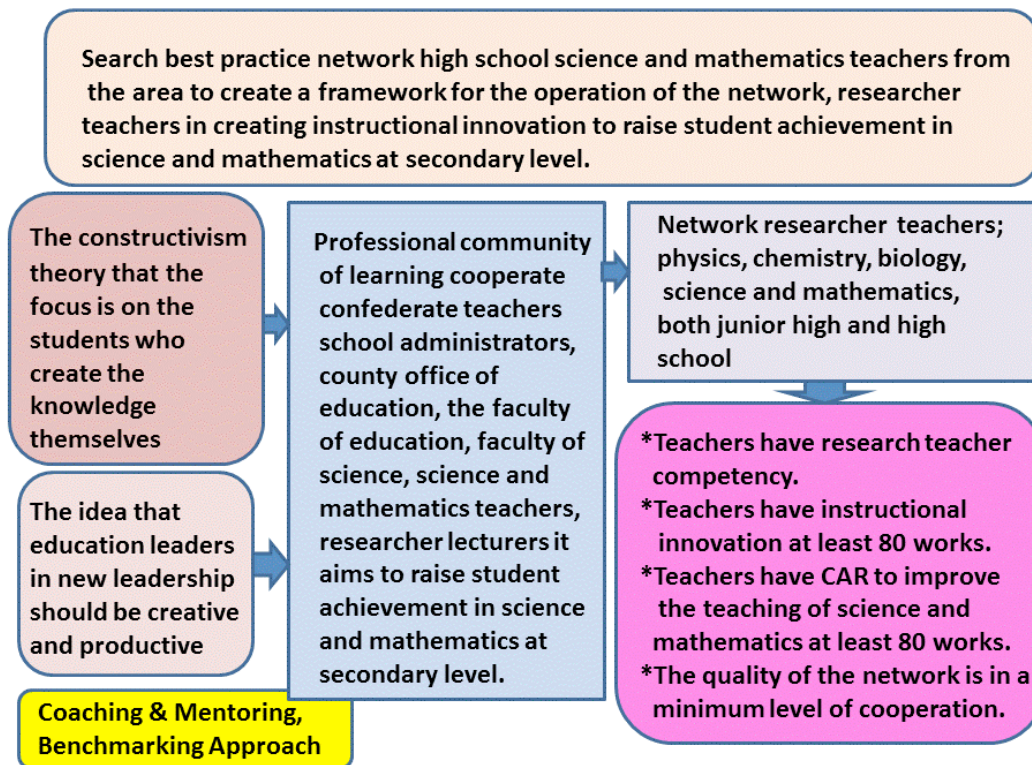
The concept of network and network development; the network of individuals, organizations, agencies or institutions are linked together under the coordination or agreement, either together as a system and doing activities together to express the behavior of the network with the key elements include common perception, common vision, mutual interests/benefits with the participation of members of the network in all stakeholders' participation, interdependence, interaction, the level of cooperation from low to high; networking, coordination, cooperation, and collaboration.

Benchmarking is the process of comparing the best practices in the manner to find out how to best practices from other agencies for similar processes and good practices or best practice of other organizations for application in their agency to improve efficiency and effectiveness.

Coaching and mentoring is an important technique to help promote the learning of personnel to staff the learning will be crucial to the success and benefits to the organization and personnel work to achieve the following goals by coaching taught to learn the guidelines and process research innovation to stay in school, in the work undertaken by the recipients of teaching is a research laboratory classes in the standard section, mentoring is a consulting or teaching to teachers, researchers in both the performance or teacher, researcher of the old school who has a high level of standards in matters relating to research, develop innovative ways to raise achievement and to make the potential to become a teacher, researcher higher that will contribute to the development of the organization in the future.

Professional learning community (PLC) is an extended learning opportunity to foster collaborative learning among colleagues within a particular work environment or field, through planning a shared vision the mutual exchange of learning and the culture or community to share and learn in organization.

**Conceptual Framework**



**Research Question**

1. What are activities supporting the creation and development of instructional innovation for raising students' learning achievement in science and mathematics education?

2. However bench marking and coaching and mentoring strategy are the process of developing strategies to create a teacher researcher's to create instructional innovation for raising students' learning achievement in science and mathematics at the secondary level?

3. How is the effectiveness of teacher development to create instructional innovation for raising students' learning achievement in science and mathematics at the secondary education level?

4. How are the factors and obstacles to the implementation of a network of teacher researcher's network to create instructional innovation for raising students' learning achievement in science and mathematics at the secondary education level?

**Research Objective**

The main research objective is to develop a model of teacher researcher's network to create instructional innovation for raising students' learning achievement in science and mathematics at the secondary education level. The sub-objectives aimed to;

1) Prepare the implementation framework of the teacher researcher's network.

2) Develop the teacher researcher's network by using benchmarking and coaching & mentoring strategy.

3) Study the effectiveness of the model of teacher researcher's network.

4) Disseminate a body of knowledge of the teacher researcher's network and extend the participation and performance evaluation of the network.

**Research Methodology**

The research followed the research and development (R & D) as the followings;
**Phase 1: Preparation of strategic guidelines of cooperation in educational development**. It operated by providing the framework for the operation of the network, teachers, researchers in creating instructional innovation for raising students' learning achievement in science and mathematics at the secondary education level. Gather information about programs and resources that are essential to learning, group learning science and mathematics in the Naresuan University. It collects various projects related to the development of teaching and learning in basic education levels between Naresuan University and institutions in Phitsanulok province, qualifying projects to enhance learning and education. Science and mathematics teachers selected to participate in the project through coordination with supervisors from the secondary educational service area office 39 and 42, both districts to voluntarily participate in the program. Meeting in small groups is an activity to develop strategies and elaboration of the strategy. The variables studied include 1) the importance and value of activities that have a system of education, science and mathematics education in the area 2) projects/activities that will enhance learning and education, teachers, researchers in creating innovation.

**Phase 2: Developing a model of teacher researcher's network to create instructional innovation for raising students' learning achievement in science and mathematics at the secondary education level**.
It operated by using the data based on the first step to create a network of teachers, using the dual strategy benchmarking relative performance and the coaching process by supervisors and mentoring by faculty researchers. The components of the developed model of teacher researcher's network include; 1.Objective 2.Principle 3.Process and 4.Learning outcome. Action was reviewed by considering the appropriateness and feasibility of the implementation problems are actually from the barrage of comments from stakeholders representing teachers, supervisors, faculty researchers and qualified educators in a total of 15 people.

**Phase 3: Evaluating the quality of the teacher researcher's network**.
The effectiveness of the network of researcher teachers in this process conducted with 110 teachers from the secondary educational service area office 39 selected schools participating 9 School teachers attended by 44 people, the secondary educational service area office 42 has teachers participating on a voluntary basis including 66 people from 28 schools. The process leading network model to a focus on participatory action research process, the study focused on the outcome and teachers in three areas: 1) Teachers have research teacher competency 2) Teachers have instructional innovation at least 80 works 3) Teachers have CAR to improve the teaching of science and mathematics at least 80 works and the quality of the network is in a minimum level of cooperation networks, and the results on the strength of the network operation.

**Phase 4: Disseminating a body of knowledge of the teacher researcher's network**.
The target groups were classified into 3 groups as follows: 1) The 110 teachers from the learning substance of mathematics, science, physics, chemistry and biology in secondary education schools in 6 sub-networks under the jurisdiction of the office of secondary educational service area 39 and 42 and 2) 5 educational supervisors from the office of secondary educational service area 39 and 42 and 3) 6 lecturers as researcher

team from education faculty, 3 lecturers from science faculty and a professor of educational research as a program consultant.

**Conclusion**
This research is currently in phase 2. The results revealed that:

1. In area-based context, there were five major science and mathematics-related projects which represented the importance and value of the learning activity in educational system. After the small groups meeting, the issues related to the development of 5 strategies include creating and linking were proposed as follows: 1) building the teacher researcher's network 2) developing the capability of teacher researcher's network 3) constructing the relationship between the 6 sub-networks of teacher researcher's network 4) monitoring and supporting the operations of teacher researcher's network and 5) empowering the development of socio-political and educational policies concerning the reformation of teacher education and professional development of teacher as researcher.

2. The model of teacher researcher's network was developed and consisted of objective model is to develop teachers participating; 1. A network of teacher researcher's network to create instructional innovation for raising students' learning achievement in science and mathematics at the secondary education level with a strong network of no less than the level of cooperation as agreed. 2. Capable teacher researchers 3. Innovative teaching that can lift student achievement in science or mathematics education. 4. Research the classroom to improve teaching science or mathematics education, principle model consists of; 1. Action network is a system, the sequence of steps consistent with the objectives and principles. 2. The teacher participants to learn by participating learning network members focused operating strategies match the performance. 3. Highlights the supervisors who served coaching and university research serves mentoring, 5 important processes as follows: 1) the paradigm shift of teacher's perceptions toward the classroom action research (CAR) – the teachers started from the problems analysis in innovative ways in order to gain insights about how to raise students learning achievement 2) the situational analysis to determine the workload, delegate responsibility to work together as a learning community network, set professional goals and agreements, empower and motivate the adoption of AIC technique 3) Both the innovation of teaching and the classroom action research to raise students learning achievement was considered as a collaborative and mutual responsibility of teachers 4) the monitoring, evaluating and reviewing of the principal researchers and 5) sharing and reviewing the work to develop the guidelines for improvement. Brainstorming sessions with stakeholders indicated that the teacher researcher's network model, it is appropriate to put into practice. Variations into practice focus on providing innovative solutions to teachers teaching science and mathematics in a class of its own. Bring innovation to focus on student learning is important by focusing on the students' learning process. The network is a teacher in the same subnetwork as a voluntary partner learning. Facebook a network of researcher teacher in science and mathematics is a learning resource of teachers, supervision has served as a coach of instructional development, researchers from Naresuan University as a mentor in classroom action research provides activity tracking progress and exchange knowledge about instructional innovation and action research in the classroom.

**Recommendation for Adoption**

1. The potential to be developed to enable teachers to become teachers, researchers need to do the following; developed for teachers to have the competency for research to improve the quality of their teaching process to students can develop to occur in both cases at the beginning of the attention needs to be developed by the teachers themselves and managed by the regulatory bodies. The process must be on building a common understanding, system of a partner engaged couple learns, the focus is on area-based context, working together with goodwill and mutual respect, there were 5 strategies include creating and linking were proposed as follows: 1) building the teacher researcher's network 2) developing the capability of teacher researcher's network 3) constructing the relationship between the 6 sub-networks of teacher researcher's network 4) monitoring and supporting the operations of teacher researcher's network and 5) empowering the development of socio-political and educational policies concerning the reformation of teacher education and professional development of teacher as researcher similar findings of Kaewurai, Wattanatorn, Kearmaneerat, Suwannasri and Thummasit. (2012, p. 261) to give recommendation for adoption in the philosophy of Sufficiency Economy for initiative a principle for the development thus focus should be on creating a consistent understanding of all parties to truly achieve the goal. Especially those who are critical, enterprise-class university is Dean of the Faculty of Education, Associate Dean for Academic Affairs of each institution should adopt a common policy for planning, and integrating the philosophy of Sufficiency Economy in each course in the teaching profession. Students Teacher continues to develop early in the course of a teacher as well as practical experience has led to teachers in schools. As well as a visionary teacher, teacher professional development, learning and understanding in students. Support measures, including the approach to supervision in the learning process and a friend. The process of action research has four main research processes using a step by step plan, the implementation of the plan, and the evaluation of the performance. And to develop action plans to improve teaching and learning. There are things that must be considered is made to understand the contents related to the philosophy of sufficiency economy.

2. The model of teacher researcher's network consisted of 5 important processes as follows: 1) the paradigm shift of teacher's perceptions toward the classroom action research (CAR) – the teachers started from the problems analysis in innovative ways in order to gain insights about how to raise students learning achievement 2) the situational analysis to determine the workload, delegate responsibility to work together as a learning community network, set professional goals and agreements, empower and motivate the adoption of AIC technique 3) Both the innovation of teaching and the classroom action research to raise students learning achievement was considered as a collaborative and mutual responsibility of teachers 4) the monitoring, evaluating and reviewing of the principal researchers and 5) sharing and reviewing the work to develop the guidelines for improvement. Brainstorming sessions with stakeholders indicated that the teacher researcher's network model, it is appropriate to put into practice. This represents a change would cause a behavior or an action to start with the idea to change the view in the paradigm shift of teacher's perceptions toward the classroom action research (CAR) then create a better understanding of what causes such clarity similar findings of Moomark, Onthanee, Kaewurai, and Rinjalean (2014) who has done research a curriculum development to enhance classroom action research's competency with knowledge management network for teachers, and met 1.

The essential classroom action research's competency for teacher was categorized into three facts: content knowledge classroom action research 1) The important and meaning of the research 2) Objective of the research 3) Process of the research 4) The innovation 5) Evaluation and Assessment. The competency of classroom action research consisted of four steps as follows: 1) Finding problem 2) Selecting the innovation 3) Constructing innovation 4) Reporting the innovation and knowledge management network can be divided in to four sessions; 1) to create network and define what they want to know 2) to find knowledge 3) to construct innovation and sharing the knowledge 4) to store knowledge and publication. 2. Components of the curriculum were1) principles and necessities, 2) objectives 3) content structure 4) knowledge management network activities, 5) evaluation. The quality of curriculum was appropriate at a high level. 3. The results of using training curriculum revealed that: 3.1 the comparing knowledge and understanding of teachers after training was higher than before the use of training at the level of significance of .01 3.2 the study and compare classroom action research's competency with knowledge management network for teachers were higher than the criterion 75 percent. 3.3 Study attitude of teacher on the use of curriculum development to enhance classroom action research's competency with knowledge management network for teachers after training level very good.

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