Influences of strategies, knowledge sharing and knowledge transfer on the success of university-school collaboration in research and development

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Abstract

This research aimed at 1) studying the situation of the university-school collaboration in research and development 2) developing and validating the success model of the university-school collaboration in research and development and 3) studying the influences of strategies factor, knowledge sharing and knowledge transfer on the success of the university-school collaboration in research and development. The research conceptual framework was the success of collaboration causal model which was developed based on Dyer and Powell's causal model of knowledge sharing, integrated with Wu and other's concept on collaboration strategies, Daniel, Hempel and Srinivasan's knowledge transfer concept, and Brookhart and Loadman's concept on different in working culture. The sample group consisted of 569 teachers and 38 school administrators from 18 basic education schools participated in the pilot project for accelerating the cultivation of desirable characteristics of Thai children and youths and 25 university researchers. The total 632 samples were drawn by multi-stage sampling. The research instruments were 3 set of questionnaires for teachers, school administrators, and university researchers, each of which had reliability of 0.985, 0.978 and 0.965 respectively. Data were analysed by descriptive statistics, analysis of variance using SPSS program, confirmatory factor analysis and the analysis of structural equation model using LISREL program. The analysis of qualitative data used the content analysis.

The major research findings were 1) the university-school collaboration for each school was a financial supported collaboration between 1 - 2 mentor researchers from the university and 5 – 20 school core teacher, having different work culture aiming to achieve the mutual goal. The significant activities were knowledge sharing and transfer through continuous, formal and informal meeting for the whole semester. 2) The causal model of success in collaboration was fit to the empirical data with chi-square = 268.493, df=24, p=0.166, GFI=0.969, AGFI=0.942, RMR=0.044. 3) Strategies, knowledge sharing and knowledge transfer has indirect effects of -0.002, 0.147, 0.099 respectively on success of research collaboration via satisfaction, trust and commitment. Commitment had the strongest direct effect of 0.256 on success of collaboration.

Keywords: University-school collaboration in research and development, collaborating strategies, knowledge sharing, knowledge transfer,

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Introduction

Collaboration is a significant attribute conducive to the success of the teamwork. There are many models of Collaboration as provided in the National Education Act 1999, Section 29, which stipulated that schools, in collaboration with community, community organizations, local administrative organizations, private sector, private organizations, and other social institutions, shall provide learning process in community (Office of the National Education Commission, 2002). Therefore, collaboration could be done in various models such as collaboration between community and educational institutions, private sector and educational institutions, professional organizations and educational institutions, university and educational institutions. Therefore, the author was interested in studying the collaboration between university and schools. If university researchers work with school teachers, the latter would be equipped with more knowledge and wider vision. Such a collaboration is a mechanism that can develop the quality of teachers more quickly than other means.

There are many types of collaboration between university researchers and school teachers. The most important one is the university-school collaboration which sends students to practice teaching in schools. At present there is a new type of collaboration, the university-school collaboration in conducting research in schools because teachers have to conduct research to develop the learning suitable for learners at each level of education as provided in the National Education Act.

Since the Collaboration in research and development is a new thing, there is not yet a clear definition and a process measurement. According to the review of several research (Dragoon, 2004; Imperial, 2004; Gardner, 2004; Schultheiss, 2005; Katz & Martin, 1997), there were various definitions of "Collaboration". In summary, the word "Collaboration" means the cooperation within group or teamwork both in organizational and individual levels with an objective to create a useful and valuable innovation to achieve the common goal set collectively. By working together as a team everyone must get involved in every step, from setting the goal to planning, working, problem solving, investing, sharing information and responsibility, and sharing knowledge and experience all the time. Every participant must be ready to develop, realize the significance of the collaboration, recognize and trust each other, have good relationship, and be able to plan and manage the conflict and work as a team. However, not much has been mentioned about "collaboration in research and development". Therefore, the author was interested in studying the definition and the measurement of collaboration in research and development, including the factors that have influences on the success of the collaboration in research and development between university and schools. The research questions are three folds. First, what was the situation of the collaboration in research and development between university and schools? Second, what was the causal relationship of the causal model of the success of the university-school collaboration in research and development? Third, what were the factors affecting the success of the collaboration in research and development between university and schools?

Objectives of the Research

This study was aimed at answering the three research questions mentioned above, firstly, to study the situation of the university-school collaboration in research and development, secondly, to develop and examine the validity of the causal model of the success of the university-school collaboration in research and development, and thirdly, to study the influences of factors concerning strategies, knowledge sharing, and knowledge transfer on the success of university-school collaboration in research and development.

Scope of the Research

This research is a study of the collaboration between personnel of different institutions with a limited scope on the collaboration between university researchers and teachers from primary and secondary schools participating in "An Accelerated Project for Building Good Character of Thai Children and Youths" or "ABC Project" in abbreviation, which was specially supported by school principals and was in line with the needs of teachers who wanted to conduct research according to the provision by the National Education Act. Most of all, the project was characterized as a real collaboration since it met school needs, both parties took part in establishing the goals, holding a meeting regularly both within and between groups to share their knowledge, and the project received a definite financial support for its operation.

The Conceptual Framework of the Research

The conceptual framework used in this research was developed from the integration of three concepts about the factors affecting the success of the collaboration. They were the concept of strategies for the collaboration by Wu and others (2004), the concept of knowledge sharing by Dyer and Powell (2001) and the concept of knowledge transfer by Daniel, Hempel and Srinivasan (2002). The three concepts were integrated with the concept of causal factors affecting the success or promoting the collaboration derived from the research work of Brookhart and Loadman (1990). The details of each concept were as follows:

The first concept was Wu et al.'s Advantageous Strategies for Collaboration (2004). Wu and his colleague believed that successful collaboration needed effective strategies. They, therefore, used Michael E. Porter's Diamond Theory in the study of the success of the collaboration between Taiwan's Technical and Vocational college and SME's and found that Porter's Seven Strategies could be used as strategies for the collaboration. They called it "Wu et al.'s Advantageous Strategies for Collaboration", which consisted the strategy of infrastructure supporting, school competence building, school function integrating, collaboration vision building, organizational culture building, alliance networking, government supporting as shown in Figure 1.

Secondly, the concept of trust and knowledge sharing was developed from the research finding of Dyer and Powell (2001), who found that the resource sharing would be successful if the organizations had the same number of personnel, had a stability, had some prior relationships, had been located in a nearby area, had sufficient trust to regularly and continuously share knowledge and technology, and spent economically in the coordination so as to be successful in inventing new products, new technology, and new network as shown in Figure 2. Besides, the author synthesized several documents concerned (Cumming, 2003;

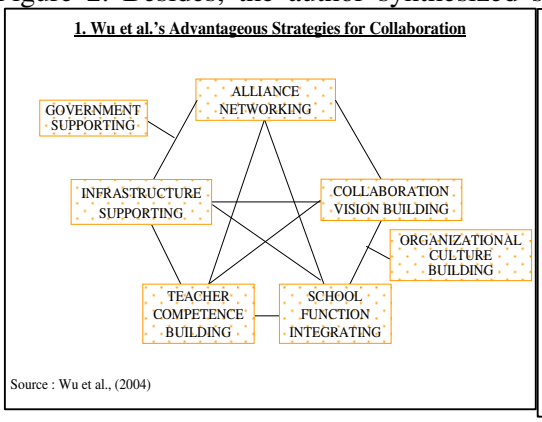

Figure 1
The Concept by Wu and others (2004)

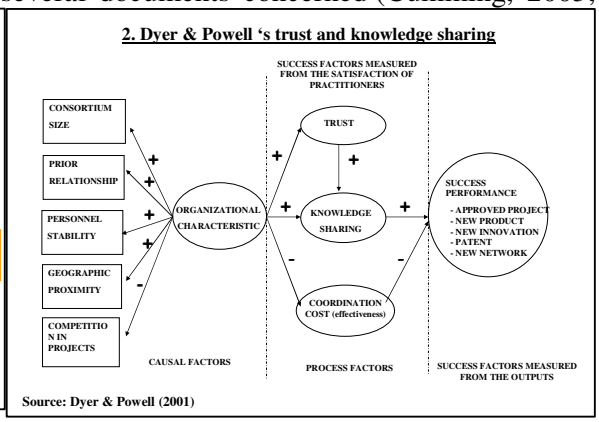

Figure 2
The Concept by Dyer And Powell (2001)

Davenport & Prusak, 2000; Hutchings & Michailova, 2003; Law & Ngai, 2007; Du, Ai & Ren, 2007, Renzl, 2008). It was concluded that the knowledge sharing means the process of transferring and sharing information, skills which could be measured by the volume of knowledge sharing (frequency and time spent) and the form of knowledge sharing (form and potential of knowledge sharing). Trust means belief, faith, and expectation of recipients toward source, which could be measured from reliability, willingness to protect, and warmth (McAllister, 1995; Mayer, Davis & Schoorman, 1995; Robbins & Coulter, 1999; Cunningham & MacGregor, 2000). The output of the collaboration was measured from the number of projects, innovations, academic work, and networks.

Thirdly, the concept of knowledge transfer was developed by Daniel, Hempel and Srinivasan (2002), who found that the organizations which could enhance research capacity would increase knowledge for their organization. This would result in the transfer of knowledge among individuals within the organization and among network organizations. Finally, there would be satisfaction of the collaborators, which would lead to the job commitment of all concerned for further implementation as shown in Figure 3. In addition, the author synthesized the research materials written by several researchers (Argote & Ingram, 2000; Gouza, 2006; Yakhlef, 2007; Cumming, 2003) and concluded that the meaning of knowledge transfer used in this research was the process of transmitting information, skills, and experiences or best practice from source to recipients who had potential to learn, absorb, and integrate new information with old knowledge and manage to construct new knowledge to enhance the efficiency of the organizations.

As for Satisfaction, Somwang Pitiyanuwat and Nonglak Wiratchai (1996) concluded that it was the mental attribute which indicated the feeling of happiness toward conducting research and working together, which could be measured from the condition and atmosphere of working, the benefit from work, the worthiness of time spent, career path opportunity, and equality of right. Regarding to the Commitment, from the review of materials written by several researchers (Lodahl & Kejner, 1965; Weissenberg & Gruenfeld, 1968; Schuler, 1977; Kanungo, 1982; Brown, 1996; Steers & Black, 1999; Ivancervich & Matterson, 1999) it could be defined as the belief in value of work, responsibility and devotion to work and the joy of work as demonstrated in figure 3.

The fourth concept was the four dimensions of differences in schools and university cultures developed by Brookhart and Loadman (1990, 1992). They believed that when two groups of people with different cultural background collaborated, it was impossible to unite their ideas as one. There would be a gap of thinking which affected the collaboration. The 4 dimensions included the work tempo, professional focus, career reward structure and sense of personal power and efficacy as shown in Figure 4.

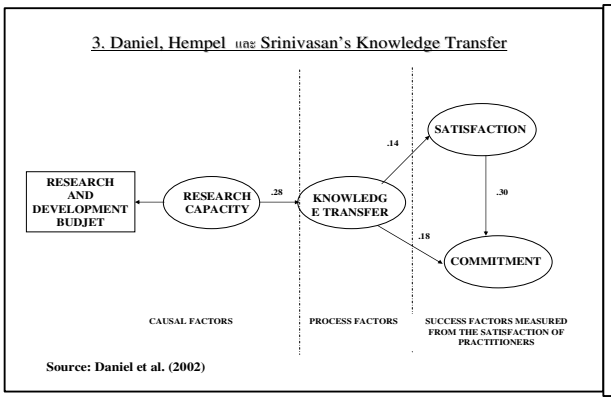

Figure 3
The Concept of Daniel, Hempel and Srinivasan (2002)

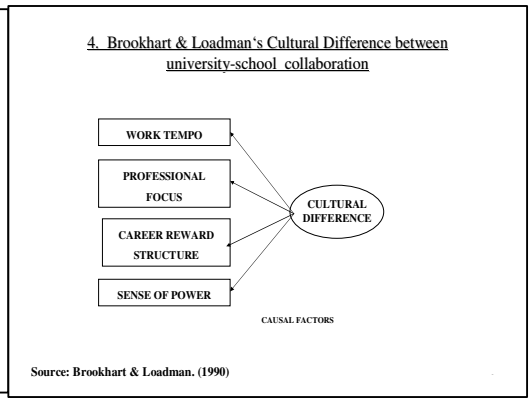

Figure 4
The Concept of Brookhart and Loadman (1990)

In order that the study of the influences of strategies, knowledge sharing and knowledge transfer on the success of university-school collaboration in R&D is theoretically correct, the authors decided to study the Project of Accelerated Project for Building Good Character of Thai Children and Youth (Suwimon Wongwanich, 2005), which was the collaboration on R&D between Chulalongkorn University and 18 schools in Bangkok.

This project had three special characteristics. First, it was the collaboration between university and schools in which coordinating researchers were doctoral candidates in research methodology who had high level of knowledge and experience in R&D. These researchers had already completed their coursework and had enough time to visit schools, give advice, and collaborated with schools to their fullest potential. Secondly, the collaboration was officially approved by school administrators, and financially supported by the university. Lastly, the collaboration was in accordance with teachers' needs.

Because of the three special characteristics the Project, some variables such as school administrators had no variation among school. Moreover, the scope of study was limited to the

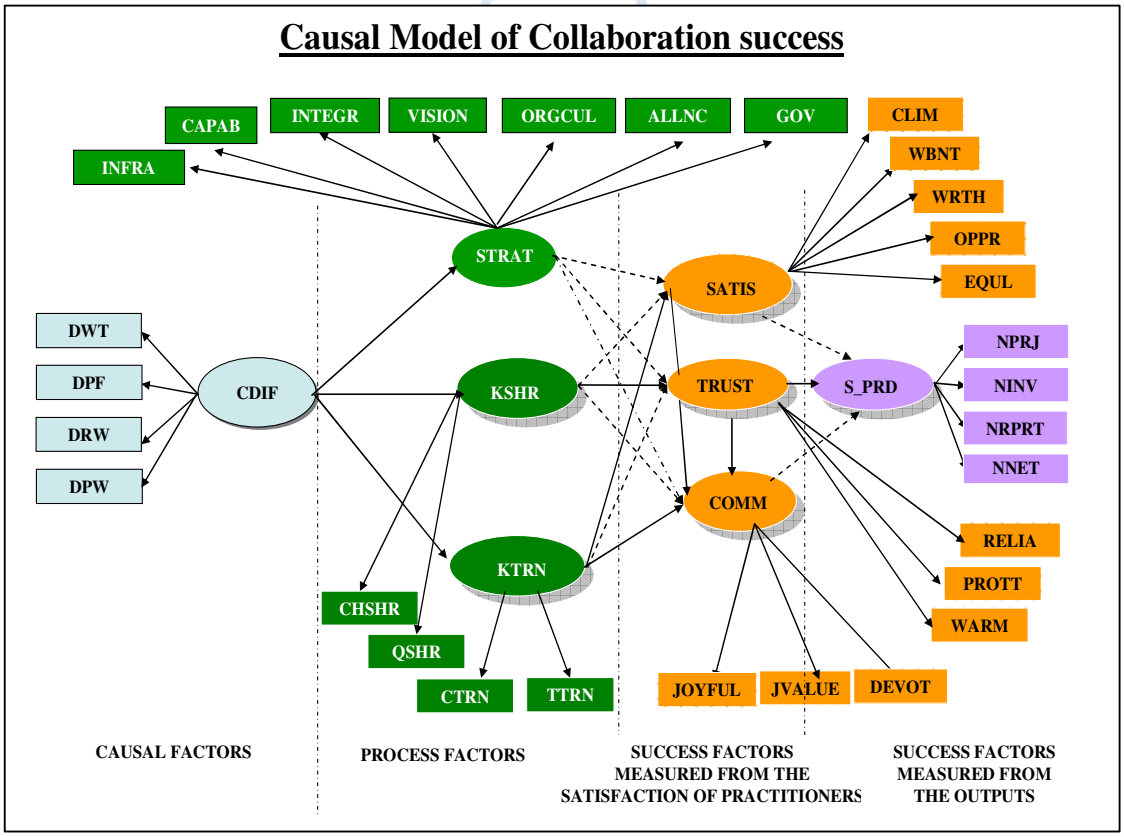

Figure 5
The Causal Model of the University-School Collaboration Success

collaboration between individuals, therefore, the authors deleted variables not involved. Eventually, the conceptual framework of this study was developed as shown in Figure 5. (See abbreviations of the technical terms used in the model in appendix)

In Figure 5 the dotted lines represent the factors which the researchers added in the model, as deemed suitable with the context in Thailand. The proposed model was originally scrutinized by a group of researchers through a focus group discussion.

Research Hypothesis

The causal model developed in this study was based on the hypothesis that the factor concerning cultural difference (CDIF) was an external latent variable which had a direct influence on the factors such as the collaboration strategy (STRAT), knowledge sharing (KSHR) and knowledge transfer (KTRN) and that the factors concerning the collaboration strategy (STRAT), knowledge sharing (KSHR) and knowledge transfer (KTRN) had an indirect influence on the factors concerning the success of the collaboration measured by the product (S_PRD) through the factors concerning satisfaction (SATIS), trust (TRUST) and commitment (COMM)

Research Methodology

This research was designed to be a correlation research with the components as follows:

Population covered all teachers and school administrators in schools providing basic education which participated in the collaboration project in research and development with researchers from the Faculty of Education, Chulalongkorn University and other universities including assistant researchers who were doctoral program students. The total number of the population was 1,257.

Sample was drawn from teachers participating in the Pilot Project for Accelerating the Cultivation of Desirable Characteristics of Thai Children and Youths by multi-stage sampling technique. The total 746 samples consisted of 675 teachers, 45 school administrators, and 26 university researchers.

Research Instruments Regarding the quantitative data, the author used 3 sets of questionnaires for teachers, school administrators, and university researchers or those participating in the Pilot Project for Accelerating the Cultivation of Desirable Characteristics of Thai Children and Youths. The three sets of instruments were tested for the reliability of each component by Cronbach's alpha coefficient, and the result turned to be high between 0.792 – 0.965. The author then analyzed the components to confirm the 8 latent variables which included the cultural difference (CDIF), collaboration strategy (STRAT), knowledge sharing (KSHR), knowledge transfer (KTRN), satisfaction (SATIS), trust, commitment, and the collaboration success measured by product (S_PRD). It was found that every latent variable had construct validity and could be truly measured by tangible variables or indicators in each model, as shown in Table 1.

Table 1 Reliability and Construct Validity

Components	Reliability (teachers)	Reliability (Administrators)	Reliability (University Faculty)	Construct validity	Construct reliability
1. CDIF	0.901	0.848	0.896	χ^2=18.109, df=15, p=0.257	0.162 – 0.936
2. STRAT	0.919	0.947	0.842	χ^2=6.322, df=7, p=0.503	0.615 – 0.842
3. KSHR	0.965	0.918	0.837	χ^2=0.009, df=1, p=0.922	0.149 – 0.535
4. KTRN	0.954	0.928	0.902	χ^2= 0.464, df=12, p= 0.496	0.027 - 0.866
5. SATIS	0.973	0.959	0.933	χ^2=1.837, df=2, p=0.399	0.616 – 0.880
6. TRUST	0.971	0.952	0.911	χ^2= 0.826, df= 1, p= 0.363	0.788 - 0.909
7. COMM	0.877	0.825	0.792	χ^2= 1.478, df= 1, p= 0.224	0.025 – 0.946

As for the qualitative data the author used a semi-structured interview composed of the questions concerning the features and forms of the collaboration in research and development, and the factors which had influences on the success of the collaboration in

research and development in 6 issues 1) The condition and features of the collaboration with an emphasis on the beginning of the collaboration, the development, and changes in the features of the collaboration including the opinions and feelings about the features of the collaboration, 2) The frequency of the collaboration, placing an emphasis on the opinion of how the collaboration in research and development put a burden on teachers and the way teachers used for solving the problems of hard work load, 3) The factors which had influences on the collaboration in research and development as perceived by teachers, including their roles in making the collaboration successful, 4) The opinions about the collaboration after the completion of the ABC Project, with an emphasis on the continuity, intensity, and teachers' attention on it, 5) The opinions about the needs for supporting and empowering the collaboration, and 6) The opinions about the future of the collaboration in research and development of schools.

Data Collection For the 26 university researchers the questionnaires were sent and returned by mail and/or electronic mail. The return rate was 96.15 %. For the 675 school teachers and 45 administrators, the author collected data oneself in order to explain the details and how to fill out the questionnaires. The respondent rates were 84.30 % and 84.44 % respectively.

Data Analysis There were three steps in analyzing the data. In the first step the author analyzed the data to examine the quality of the data in terms of reliability and construct validity by using Cronbach's alpha coefficient and confirmatory factor analysis. The second step was the analysis of the data to measure the frequency of the background factors of the sample and study the feature of the distribution and measure the tangible variables used in this research by using an analysis of variance (ANOVA) to compare the mean of the key factors in this study such as sex, age, educational background, work experience and school size by using the SPSS for windows. The third step were an analysis of the data to meet the research objectives by using a content analysis from a qualitative data to analyze the condition of the university - school collaboration in research and development, an analysis to examine the reliability of the causal model of the success of the university-school collaboration in research and development, and an analysis of the influences of strategy, knowledge sharing, and knowledge transfer on the success of the university-school collaboration in research and development by using the LISREL program.

Research Findings

1. The Condition of the University-School Collaboration in Research and Development

The university-school collaboration in the ABC Project was a collaboration between those who had prior relationship because the sample was obtained by a snow ball technique, as said by one school administrator, "*Chulalongkorn University researcher called me to invite to participate in the program and nominate the secondary schools which might be interested, I then proposed 2-3 schools including Matayom Prachanivate School, Pong Ploy Anusorn School, and Pianpin Anusorn School…"* Furthermore, it was the research collaboration between 1-2 university researchers and 5-20 teachers per school. Both groups had differences in the working culture and the recognition of the strategy to support each other for better collaboration.

According to the comparison of the difference in working culture, it was found that university researchers evaluated themselves higher than teachers in every aspect. For example, university researchers could provide time for conducting research at all time while teachers could not because they had to teach in the classrooms almost all day long and had a lot of other work to do. It could be said that university researchers realized that they had good

knowledge in research, received both intrinsic and extrinsic rewards, and were successful in their work. Besides, they might have a sense of high academic power while teachers evaluated themselves as having little knowledge about research, as shown in figure 6.

In the mean time it was found that university researchers and teachers acknowledged, though in different meaning, that strategies were used to enhance the collaboration. That is, most teachers acknowledged that about 2 measures per strategy were used ($\bar{x}$ was between 1-909-2.030) while university researchers acknowledged that 2-4 measures per strategy were used ($\bar{x}$ was between 2.320 -4.200), as shown in figure 7.

As for Knowledge Sharing, the finding yielded similar results. University researchers and teachers acknowledged the amount and features of knowledge sharing differently. The

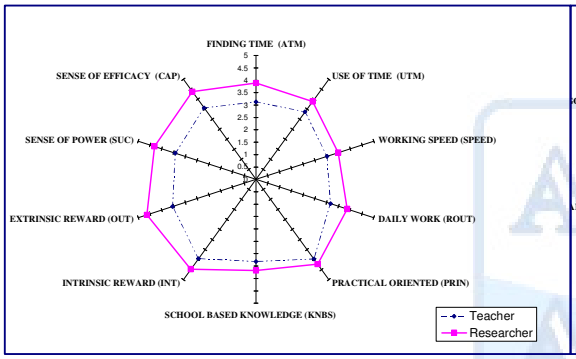

Figure 6
Comparison of Cultural Difference between Teachers and University Researchers

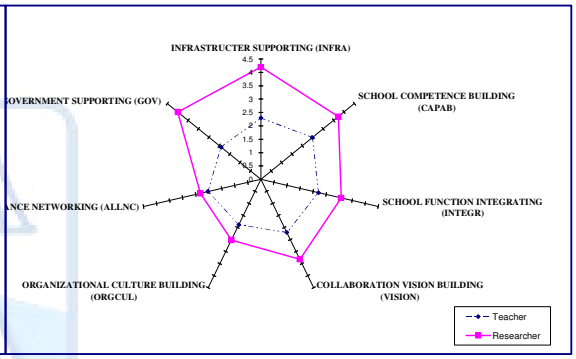

Figure 7
Number of Measures per Strategy whichwere acknowledged by Teachers and University Researchers

former acknowledged in higher level than the latter in every aspect. For example, teachers revealed that they spent 1.30 – 2 hours sharing knowledge with university researchers each time, but the latter said they spent as long as 2-6 hours because they included traveling hours in it. Moreover, university researchers indicated that most of the time the knowledge sharing was informally conducted ($\bar{x}$ =3.832 and 3.070 respectively). University researchers demonstrated their higher potential in the preparation and the process of transferring knowledge ($\bar{x}$ for university researchers was between 3.728 – 4.216 and $\bar{x}$ for teachers was between 3.379 – 3.453), as shown in figure 8

As for Knowledge Transfer, it was found from the analysis that there were 18 teachers in average participating in the process and 1-2 university researchers acting as mentors in transferring knowledge to teachers for the implementation of the development of learners. And yet, teachers admitted that they could absorb the knowledge less than what university researchers tried to transfer and they could implement the knowledge lower than university faculty's expectation, as shown in figure 9.

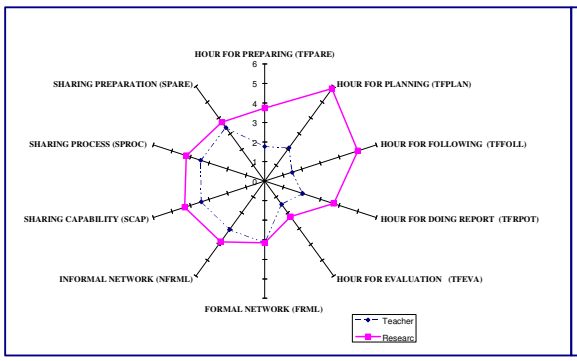

Figure 8
Amount and Features of Knowledge Sharing which were acknowledged by Teachers and University Researchers

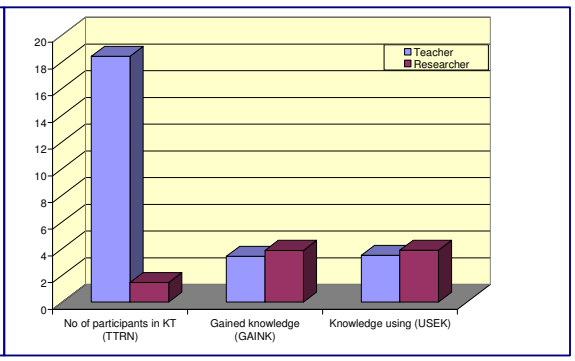

Figure 9
Comparison of Features of Knowledge Transfer between Teachers and University Researchers

Moreover, in response to the question of how the university-school collaboration in the future should be, most of them gave many interesting suggestions as follows: 1) Both sides should work together closely, continuously, and regularly, and teachers should be allowed to ask questions concerning the research in a friendly atmosphere as "think together, construct together, develop together, disseminate together (friends helping friends)" because teachers had a heavy teaching load and it was too difficult for them to conduct research alone. 2) The collaboration should be designed as a complete circle of work in order to enhance the efficiency. By this meaning university researchers should act as facilitators, who transfer knowledge, suggest, guide, and coach friendly. Teachers as practitioners should pay attention, sincerely implement the knowledge received and be well supported by school administrators. Finally university researchers should monitor and guide teachers individually. They should visit schools beforehand to collect data, understand the real situation of the school context and teachers. 3) A proper amount of time should be allocated and the work of both sides should be integrated so as to ease the management.

2. **The validity test of the causal model of success of university-school collaboration in research and development**

The validity test of the causal model of success of university-school collaboration in research and development yielded the result that the model was fit to the empirical data (χ^2 =268.49; df = 247; p = 0.166; GFI = 0.969; AGFI = 0.942; RMR = 0.045). The causal factors and process factors in the model could explain SATIS at 89%, TRUST at 87%, COMM at 90%, and S_PRD at 7% as shown in Figure 10 and 11.

The factor loading value of every external latent variable turned out to be positive and significantly different from zero. DRW yielded the highest value (0.88), followed by DPF, DPW, and DWT which were 0.85, 0.66 and 0.56 respectively as shown in Figure 10. Those four factors loading value could explain 43%, 72%, 31% and 78% of CDIF respectively as demonstrated in Figure 11.

Regarding the values of every internal latent variable, it was found that JOYFUL had a negative value at -0.19. The rest of them were positive, significantly different from zero and had similar values between 0.71-0.92 except QSHR (0.27), CTRN (0.20) and NPRJ (0.57). As for STRAT factor, VISION yielded the highest value (0.91) followed by ORGCUL, INTEGR, INFRA, CAPAB and ALLNC, and GOV which were 0.90, 0.89, 0.86, 0.84 and 0.78 respectively as shown in Figure 10. Those factors loading value could explain 82%, 81%, 78%, 74%, 71%, 70% and 61% of STRAT respectively as shown in Figure11. Similarly, the five factor loading value of CLIM, WBNT, WRTH, OPPR and EQUL could explain 67%, 80%, 88%, 79% and 86% of SATIS as shown in Figure11, etc.

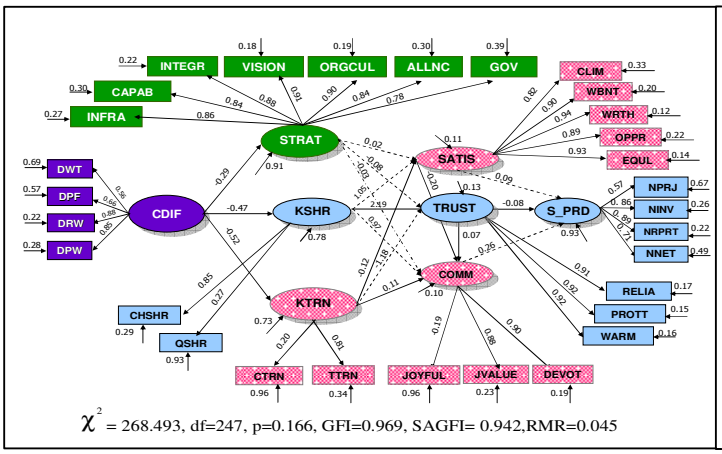

Figure 10 Causal Model of Collaboration Success

Squared Multiple Correlations for Structural Equation

Struacural Equation	STRAT	KSHR	KTRN	SATIS	TRUST	COMM	S_PRD
Rsquare	0.09	0.22	0.27	0.89	0.87	0.90	0.07

Squared Multiple Correlations for X-Variables

Variable	DWT	DPF	DRW	DPW
Rsquare	0.31	0.43	0.78	0.72

Squared Multiple Correlations for Y-Variables

Variable	INFRA	CAPAB	INTEGR	VISION	ORGCUL	ALLNC	GOV
Rsquare	0.74	0.71	0.78	0.82	0.81	0.70	0.61
Variable	CHSHR	QSHR	CTRN	TTRN	CLIM	WBNT	WRTH
Rsquare	0.72	0.07	0.04	0.66	0.67	0.80	0.88
Variable	OPPR	EQUL	RELIA	PROTT	WARM	DEVOT	JVALUE
Rsquare	0.79	0.86	0.83	0.85	0.84	0.81	0.78
Variable	JOYFUL	NPRJ	NINV	NRPRT	NNET		
Rsquare	0.04	0.33	0.74	0.78	0.51		

Figure 11 Construct Reliability

As for the coefficient value of direct influences from one internal latent variable to another or coefficient value in matrix parameter BETA shown in Figure 10, it was found that only 2 out of 14 paths were significantly different from zero at 0.05. They were the path from KSHR to TRUST and that from COMM to S_PRD. Meanwhile, each of the 4 paths of coefficient values in matrix parameter GAMMA was significantly different from zero at 0.01. The analysis showed particularly direct influences of causal factors of success in collaboration which should be studied along with indirect influences and will be presented in the following item 3.

3. The Study of Influences of Strategies, Knowledge Sharing, and Knowledge Transfer on the Success of University-School Collaboration in Research and Development

The Study of Influences of Strategies, Knowledge Sharing, and Knowledge Transfer on the Success of University-School Collaboration in Research and Development shown in Table 2 yielded the following analysis results

1) STRAT, KSHR, and KTRN had different influences on S_PRD. KTRN had direct influences on COMM, which had direct influences on S_PRD significantly enabling the KTRN to have indirect influences through COMM to S_PRD with an indirect influence at 0.099. However, KSHR had direct influences on TRUST, which had direct influences on COMM and direct influences on S_PRD, resulting in the KSHR having indirect influences through TRUST and COMM to S_PRD with an influence at 0.147. As for the STRAT which according to the research conceptual framework would have indirect influences through SATIS, TRUST, and COMM to S_PRD. It was found that the indirect influence was at -0.002, which was not significant.

Considering CDIF as an external latent variable, it was found that CDIF had direct influences on STRAT, KSHR, KTRN significantly with the influence values at -0.293, 0.472, -0.519 respectively. When interpreting the meaning and influences of the three variables on S_PRD, it was found that CDIF had an indirect influence through STRAT, KSHR, and KTRN to S_PRD with the value of indirect influence at -0.120, which was different from zero significantly. In other words, CDIF had indirect influences on S_PRD through KSHR and KTRN, which had direct influences on TRUST and COMM, which had an influence on S_PRD in the final step.

When considering from the size of influences which were significant, it could be said that the CDIF had indirect influences through KSHR, KTRN, TRUST, and COMM to S_PRD.

When considering the mediator in the causal model of success of the collaboration, the data analysis indicated that KSHR, KTRN, TRUST and COMM were the variables influenced by CDIF on the success of S_PRD while SATIS was the variable influenced by CDIF to TRUST of which the size of indirect influences was not significant.

In conclusion, the analysis of influences, both direct and indirect, of the variables in the causal model of success of the collaboration indicated that although the causal model of success of the collaboration had a validity and was fit to the empirical data, many paths of the direct influences had the size of influences which were different from zero insignificantly. That was because SATIS and TRUST were the variables which had a rather low standard deviation at 0.330 and 0.362. It may be because the amount of time in the ABC project was too short to build trust between teachers in participating schools and university researchers.

However, the result of an analysis of the values of direct and indirect influences of the variables which were causes in the causal model of success of the collaboration demonstrated

clearly the type of influences of each variable. This should be useful for researchers to use as a guideline for conducting research in order to get clearer forms of relations.

Discussion

1) The fact that teachers and university researchers had different opinions toward collaboration in research indicated that teachers and researchers had different views, belief, and working culture, especially in the case the researchers evaluated that they could allocate much time for collaborating with teachers in conducting research while teachers perceived that they had no time really had effects on the collaboration in research, which was in accordance with the findings by Brookhart and Loadman. Both found that the more cultural difference there was the less collaboration there would be. On the contrary, if there was no difference, or just a little, the collaboration would be better. According to the analysis, participants in the collaboration had cultural difference to a certain extent.

2) The collaboration concept was that participants in the collaboration should have equal knowledge and ability, join voluntarily, equal right in discussion, patience in long time research activities, dedication to work. This research found that teachers and university researchers had different working culture in every aspect. Teachers spent time for teaching than conducting research while university researchers conducted research along with teaching. Moreover, teachers played more roles as listeners than discussers. Teachers might think that they were inferior to university researchers because they had only a Bachelor's Degree and little experience in research, or not at all, though the 18 schools participating in the pilot project were selected with teachers' readiness to take part throughout the program. Such a difference had effects on the success of the collaboration. However, the problems mentioned above could be solved if university researchers and teachers in basic education institutions spent time together in working and consulting. In the ABC Project, university researchers spent time with teachers and students in average 1.30 – 2.00 hours. Therefore, in general schools university researchers should give more time to schools. Moreover, the collaboration had another important idea, "joint investment". The ABC Project was aware of this matter, therefore, a sum of money was provided for schools to facilitate their project operation.

3) According to Dyer and Powell's concept (2001), to make the joint investment successful, the partners must have prior relationship, be stable, located not too far, personnel was knowledgeable and adequate. Most of all, those organizations must be willing to share knowledge, trust each other and it must be an economical joint investment so that the output, or their collaboration, would be satisfactory, yielded new product and technology that could register for a patent, and gained new allied network for joint investment. In comparison with the operation of the ABC Project, it was found to be in line with each other. That is, schools in the Pilot Project had known each other before because they were selected from the school network that used to join in research project with the Faculty of Education, Chulalongkorn University. Their personnel were well prepared to make the collaboration efficiently successful. They are located in Bangkok metropolitan area and not too far from the university. Nevertheless, the pilot project tried to select schools from every education area in Bangkok and they were schools under the jurisdiction of every organization. The purposive sampling applied to schools with prior experiences, however, had an impact on this research because most of the samples rated themselves moderately and highly in almost every item. Thus, the scores were gathered with fairly little distribution and had effects on the data analysis to some extent.

4) Concerning the analysis of the direct and indirect influences of such variables as the collaboration strategy, knowledge sharing and knowledge transfer in the causal model of the collaboration success, although the causal model of the collaboration success had validity in

terms of fitting to the empirical data, several direct influence lines had statistical significantly. That might be because such variables as SATIS and TRUST had standard deviation as low as 0.330 and 0.362, or because the period of the ABC Project was too short to build trust among teachers from schools participating in the project and university researchers.

5) And yet, the analysis of direct influences and indirect influences of the causal factors in the causal model of the collaboration success demonstrated the format of the influence of each variable rather clearly. This might be useful for university researchers to use as a guideline for the operation of the research project to gain the clearer form of relationship.

Recommendations

1) Policy Recommendations

1.1 The high ranking officials of the Ministry of Education and Bangkok Metropolitan Administration should accelerate to promote and encourage the capacity building in research and academics for teachers and school administrators by joining universities in organizing a workshop training so that both sides get acquainted with each other and get accustomed to conducting research, and school personnel perceive research as not a difficult task. There should also be a motivation for teachers and school administrators so that teachers could apply what they learned to conduct research in real practice and perform research-based teaching activities and school administrators perform research-based school management efficiently.

1.2 The causal model of the collaboration success should be publicized to school administrators, Education Service Areas administrators, and the Ministry of Education's high ranking administrators so that they know and promote the use of this model in measuring the level of success of school-community collaboration projects.

1.3 The Education Service Areas where there are faculty of education of higher education institutions should formulate a policy of promoting the project for university-school collaboration in research and development by selecting schools situated in the nearby areas so that they have more opportunities to work together.

2) Recommendations for Future Research

2.1 Research should be done with the university-school collaboration projects using the whole school approach in order that every teacher, not only leading teachers, had an opportunity to directly share with university researchers.

2.2 Research should be done with the university-school collaboration projects which last longer than 1-2 semesters in order that both sides could have enough time to build mutual trust.

2.3 Research should be done with the university-school collaboration projects in process or at the beginning. Pre-project collecting data to survey the expectations and post-project one to study the outputs are recommended.

2.4 There should be an application of the causal model of the collaboration success with the university-school collaboration projects which last longer than 1-2 semesters in order that both sides could have enough time to build mutual trust.

2.5 For the rightfulness and clarity of the analysis, there should always be an examination of the assumption about multicolinearity and update the data appropriately before undertaking the project operation.

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Appendix:

Abbreviations of the Technical Terms used in the Model

CDIF	Cultural difference	SATIS	Satisfaction toward work
DWT	Work tempo	CLIM	Work Climate
DPF	Professional focus	WBNT	Work Benefit
DRW	Career reward structure	WRTH	Worthiness of Time
DPW	Sense of power	OPPR	Work Opportunity
STRAT	Collaboration strategy	EQUL	Equality of Right
INFRA	Infrastructure supporting	TRUST	Trust
CAPAB	School competence building	RELIA	Reliability
INTEGR	School function integrating	PROTT	Protection
VISION	Collaboration vision building	WARM	Warmth
ORGCUL	Organizational culture building	COMM	Commitment
ALLNC	Alliance networking	DEVOT	Devotion
GOV	Government supporting	JVALUE	Job Value
KSHR	Knowledge sharing	JOYFUL	Joyful Research Working
CHSHR	Sharing characteristic	S_PRD	Success measured from the product
QSHR	Sharing frequency	NPRJ	The Number of Projects
KTRAN	Knowledge transfer	NINV	The Number of Innovations
TTRN	Proportion of Participants in the Knowledge Transfer	NRPRT	The Number of Research Reports
CTRN	Constructed Knowledge	NNET	The Number of Network