Professional Learning Community with Interventions for STEM School Improvement: A Case Study of Surin Phitthayakom School, Surin Province, Thailand

Amnuay Wattanakornsiri[a], Chaisit Khunsawat[b], Panchai Kessada[c], Rawichayuth Thongmaen[b], Rungrawee Jumpadee[d], Chula Supimaros[d], Sampan Tongnunui[e], Tongsai Jamnongkan[f], Samreong Boonto[b] and Pongthipun Phuengphai[a*]

[a]Faculty of Science and Technology, Surindra Rajabhat University, Surin 32000, Thailand
[b]Secondary Educational Service Area Office Surin, Surin 32000, Thailand
[c]Faculty of Education, Surindra Rajabhat University, Surin 32000, Thailand
[d]Surin Phitthayakhom School, Surin 32000, Thailand
[e]Conservation Biology, Mahidol University, Kanchanaburi Campus, Kanchanaburi 71150, Thailand
[f]Department of Fundamental Science and Physical Education, Faculty of Science at Sriracha, Kasetsart University, Chonburi 20230, Thailand
[*]Corresponding author. E-mail address: pongthipun.ph@srru.ac.th
Received: 16 January 2023; Revised: 15 April 2023; Accepted: 28 April 2023

Abstract

Professional Learning Community (PLC) is a school improvement strategy for building teacher competencies in cooperatively learning management focusing on improving student learnings and competencies. Interventions (InTs) help to facilitate PLC to increase high learning management. This research was conducted in Surin Phitthayakhom School as a STEM school in Surin Province, Thailand, which has been implementing PLC since 2018. The research objectives were to investigate and select the best practices as InTs of Teachers' Council of Thailand to apply in developing competencies of students, teachers and principal in the school, to formulate and synthesize the mechanisms of PLC together with interventions (PLC-InTs) in order to develop the competencies of students, teachers and principal, and to study the effects of the applications of the mechanisms on the competencies. This research used experimental and qualitative methods that 49 best practices were selected by the committees of Teachers' Council of Thailand, the mechanisms were formulated and synthesized by four educational experts, and the competencies of students, teachers and principal were evaluated using evaluation forms. The results found that the best practices as InTs, which were suitably applied to the school, were problem-based learning, 5E or inquiry-based learning, think-pair-share technique, paper walk technique, gallery walk technique, high impact practices, and co-5 steps. The mechanisms were formulated to SPK2 model (START, PERFORM and KEEN OF SUCCESS), mainly comprising five steps in PERFORM, i.e. study, plan, teach and observe, reflect, and revise. Besides, the competencies of students, teachers and principal were increased after the three-cycled PLC-InTs. Hence, PLC-InTs could increase those competencies as whole school approach.

Keywords: Interventions, Professional Learning Community, Whole School Approach

Introduction

Principals, teachers and educational staffs are more efficient, productive and provoked when a school's atmosphere is penetrated with a working collaboration (Bush & Glover, 2012) and the spirit of collaboration is of utmost importance as a foundation of Professional Learning Community (PLC) (Mundschenk & Fuchs, 2016). Generally, PLC must have at least three themes comprising: 1) shared mission, vision and values, 2) collaborative teams working interdependently to achieve common goals, and 3) a focus on results as evidenced by a commitment to continuous improvement (DuFour et al., 2004). Schools as PLC need to have a clear purpose and a collaborative culture, which principals always empower teachers to be leaders, and teachers and educational staffs working

together as a PLC team are capable of turning collective inquiries to a best practice and examining current situations with a commitment to continuous improvement (Rentfro, 2007).

PLC has been applied as a strategy for school improvement and student achievement in many countries. In Thailand, Teachers' Council of Thailand has been promoting and supporting PLC in Thai schools since 2016, cooperating with Chevron Enjoy Science Project and Southeast Asian Ministers of Education Organization Secretariat STEM Education (SEAMEO STEM-ED). Their main five themes for PLC consist of: 1) shared values and vision, 2) collective responsibility for students' learning, 3) collaboration, 4) lesson study observation and suggestions from experts, and 5) creative reflection dialogue (Teachers' Council of Thailand, 2020). These organizations have analyzed bodies of knowledge from the best practices since 2021 and classified them into 7 categories comprising: 1) Digital Literacy and Computing, 2) Mathematics, 3) Science, 4) Early Childhood, 5) Reading and Writing, 6) School Reform, and 7) Life Skill. These best practices as interventions (InTs) are effectively applied to implement with PLC working environments because they have been outstanding bodies of knowledge, judged by many committees of Teachers' Council of Thailand.

The objectives of this study were to investigate and select the best practices of Teachers' Council of Thailand as InTs to apply in developing competencies of students, teachers and principal in Surin Phitthayakhom School as a STEM school in Surin Province, Thailand; to formulate and synthesize the mechanisms of PLC together with interventions (PLC-InTs) to develop the competencies; and to study the effects of the applications of the mechanisms of PLC-InTs on the competencies.

Methods and Materials

This study was the research and development using the experimental and qualitative methods, carried out during August 2021 to March 2022. A case study was Surin Phitthayakhom School as a STEM school in Surin Province, Thailand, which has continuously been implementing PLC since 2018 with the PLC project, named Thailand School Improvement Program (T-SIP), of Teachers' Council of Thailand, Chevron Enjoy Science Project and SEAMEO STEM-ED, and was awarded as an outstanding school in provincial and national levels by Secondary Educational Service Area Surin in 2021 and Teachers' Council of Thailand in 2000, respectively. The participants in this study comprised one principal, 18 teachers, and 209 students.

Investigation and Selection of Best Practices as InTs

Teachers' Council of Thailand has collected the bodies of knowledge as best practices since 2016 from main three groups comprising: PLC, One School One Innovation (OSOI) and research. There were totally 105 best practices, classified into 7 categories comprising: 1) Digital Literacy and Computing, 2) Mathematics, 3) Science, 4) Early Childhood, 5) Reading and Writing, 6) School Reform, and 7) Life Skill with the numbers of 16, 1, 13, 1, 22, 28 and 24 best practices, respectively (Teachers' Council of Thailand, 2021). All the 105 best practices were analyzed, criticized and judged by many committees of Teachers' Council of Thailand, which 49 best practices were selected to be published online with registration via Zoom Cloud Meetings during September 4-18, 2021 with a total number of 3,724 participants.

For examples, the best practices consisted of word ticket, reading practice package, keyword underline technique, area-based learning, FORNRAM (Forum, On-study, Render, Network, Announce and Model) model, BAIMON (Basic, Assignment, Indicator, Management, Observation and Network) model, project-based learning (PBL) and business model, STAR (Supporting, Team and Participation, Achieving and Realistic) model,

PORPIANG (Plan, Organize, Reflect, Project, Implement, Adjust, Notify and Goal-evaluate) model, LIKE (Life, Integrate, Knowledge and Evaluation) model, PBL and PLC model, 5E (Engage, Explore, Explain, Extend and Evaluate) or inquiry-based learning, think-pair-share technique, paper walk technique, gallery walk technique, critical friend technique, VDO analytical technique, high impact practices (HIPs), Co-5 steps (Learning to question, Learning to search, Learning to construct, Learning to communicate and Learning to serve) and so on.

Eighteen teachers and principal of Surin Phitthayakhom School learned these best practices and then they worked together as PLC teams to discuss, and each teacher chose the best practices as InTs to appropriately and effectively apply in their learning managements with PLC process as PLC-InTs in order to improve competencies of students, teachers and principal. The PLC team comprised model teacher, buddy teacher(s), expert(s) and administrator (principal) (or academician, and/or local expert). Every teacher was the model teacher in his PLC team and every model teacher opened the class using PLC-InTs three times per semester for lesson study, called three-cycled PLC-InTs.

Formulation and Synthesis of Mechanisms of PLC-InTs

Mechanisms of PLC-InTs to develop the competencies of students, teachers and principal in the school were formulated and synthesized by all the principal and teachers as well as four educational experts using the brain storming meetings in order to mainly improve the competencies of students, teachers and principal. After that, these mechanisms were evaluated by the four educational experts with the mechanisms' qualities as utility, feasibility, propriety and accuracy with the group discussion.

Study of Effects of PLC-InTs

Effects of the applications of the mechanisms of PLC-InTs on the competencies of students, teachers and principal in the school were studied by the caparison between before- and after-applying the treatments of those mechanisms with the three-cycled PLC-InTs on the competencies of students, teachers and principal. After that, the competencies were evaluated using the evaluation forms, which were proposed and adjusted by 9 educational experts from 9 Thai universities, being the committees of the board of promotion, support, dissemination and exchange of knowledge and body of knowledge to develop the depth of educational professions during 2021-2022, Teachers' Council of Thailand. The evaluation forms were performed according to Performance Appraisal Framework of Thai teachers' Academic Standings.

The evaluation forms of student's competencies comprised: 1) general competencies consisting of 5 indicators: self-management with well-beings, advance thinking and learning, language communication, management and teamwork, and strong citizenship, and 2) analytical thinking competencies consisting of 4 indicators: component analysis, relationship analysis, importance analysis, and principle analysis. Both evaluation forms were 4 point scoring rubrics, which were calculated to a total score of 100. And, the evaluated score of each student by the PLC team was classified according to the standardized ranges comprising 1-25, 26-50, 51-75, and 76-100 scores interpreting to the levels of starting, developing, ability, advanced competencies, respectively.

The evaluation forms of teacher's competencies consisted of: 1) learning and classroom managements comprising 8 indicators: students can access learning sources and understand lessons, students can link previous knowledge or experiences with new learnings, students can construct self-knowledge or create new experiences from learnings, students are motivated and encouraged in learnings, students' skills and expertise are developed from learnings, students receive reflections for improvement from learnings, students' learnings are developed in appropriate classroom atmosphere, and students can have self-controlling and self-leading of learnings, and

2) learning outcomes of students comprising 4 indicators: outcomes or performances are from teacher's learning management, outcomes or performances reflect to basic skills according to student's age and characteristics, outcomes or performances reflect to cognitive abilities according to student's age and characteristics, and outcomes or performances reflect to cross-functional skills according to student's age and characteristics. Both evaluation forms were 5 point scoring rubrics, which were calculated to a total score of 100. And, the evaluated score of each teacher by the PLC team was classified according to the standardized ranges.

Furthermore, the evaluation form of principal's competencies, emphasizing on skills of strategic planning and using administrative tools and innovations comprising 8 indicators: student-oriented solution, quality of curriculum and student, teacher and student competency development, monitoring and coaching, Quality Assessment (QA) and Continuous Quality Improvement (CQI), creative innovation, pool and alliance linkage, and collective leadership. The evaluation form was 5 point scoring rubric, which was calculated to a total score of 100. The evaluated score of the principal by every teacher in school was classified following the standardized ranges.

Results and Discussion

Results and discussion of this study are shown as the following sections.

Best Practices as InTs

After the teachers and principal studied all the 49 best practices, published online with registration by Teachers' Council of Thailand, all the teachers worked as the PLC teams to discuss the best practices. Then, they chose the best practices as InTs to suitably apply in lesson plans. After that, the lesson plans were discussed in PLC team and then used in learning managements with PLC-InTs. Their InTs comprised PBL, 5E or inquiry-based learning, think-pair-share technique, paper walk technique, gallery walk technique, HIPs, and Co-5 steps.

PLC is a long-term comprehensive professional development (Emihovich & Battaglia, 2000) and InTs are important and designed to increase the learning of students (McDougal et al., 2010). Incorporating the PLC process with InTs could create productive outcomes including teaching and learning management, and competencies of teachers and students (Gersten et al., 2000).

Mechanisms of PLC-InTs

The mechanisms of PLC-InTs were formulated and synthesized to SPK2 model as illustrated in Figure 1. The mechanisms were discussed and judged by the four educational experts from Surindra Rajabhat University, Thailand, that their qualities were very good in utility, feasibility, propriety and accuracy. The SPK2 model comprises three compositions, i.e. START, PERFORM and KEEN OF SUCCESS. START is the input consisting of student, teacher, academician, residence (community) and the principal; PROCESS is the perform using PLC for driving the school improvement together with best practices as InTs, management process, supervision process and education process; as well as KEEN OF SUCCESS is the output comprising KEEN OF STUDENT as "KONDEE" (knowledge, opening mindset, network, democracy, enjoyment and ethics), and KEEN OF TEACHER as "KRUDEE" (knowledge, responsibility, using innovation, development, evaluation and ethics).

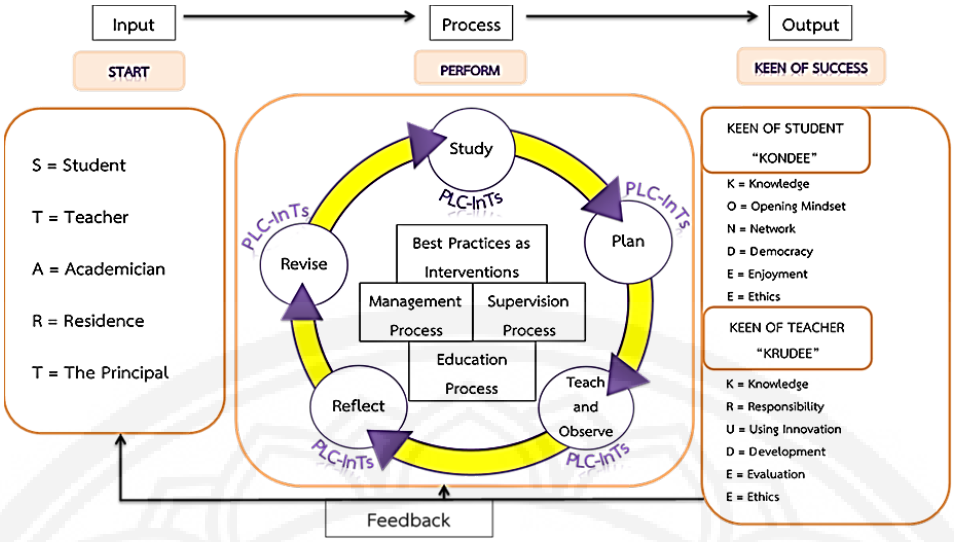

Figure 1 Mechanisms of PLC-InTs as SPK2 Model of Surin Phitthayakhom School, Thailand.

The main mechanisms of PLC-InTs were formulated into five steps as one-cycled PLC-InTs as the followings (Kenan Foundation Asia, Enjoy Science, n.d.).

1. **Study:** PLC team examines the curriculum, content, indicators, standards, lesson plans, and students' progress and readiness. The InTs were incorporated in the lesson plans with management, supervision and education processes. They determine short-term and long-term goals in learning management for improving the output for students and teachers as whole school approach.

2. **Plan:** PLC team plans the units of study, create joint lesson structure and predict what students will learn from lesson plan as lesson study. After that, they predict the students' answers and understanding, design engaging assignments, and plan data collection from assignments' assessment.

3. **Teach and Observe:** The model teacher implements the lesson in a classroom according to the lesson plan and the rest of PLC team corporately collects data as they observe the classroom opening and students' engagement.

4. **Reflect:** PLC team reflects on the data obtained from classroom observation, in which there are four main questions that must be answered. Q1: Based on the classroom observation, how did the lesson impact students' learning? Q2: Did the lesson on this particular unit or subject result in learning that will be built upon in the next learning segment? Q3: What are some shared lessons learned that should continue to be practiced? And Q4: How will the model teacher adjust his teaching plans and work assignments?

5. **Revise:** PLC team develops and improves teaching practices and assignments in according to lessons learned from joint classroom observation and data collection.

Effects of PLC-InTs

The effects of the applications of the mechanisms with the three-cycled PLC-InTs as treatments on the competencies of students, teachers and principal were illustrated in Figures 2, 3 and 4.

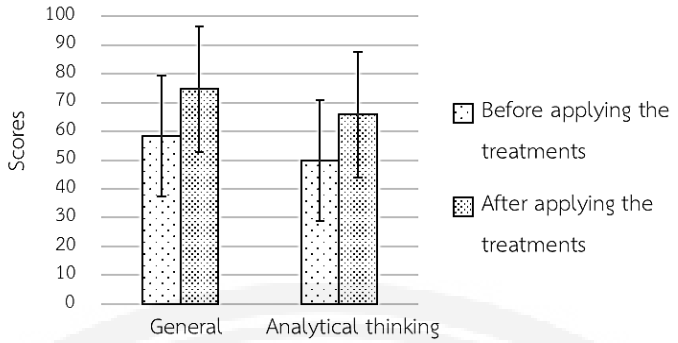

Figure 2 Competencies of Students between Before- and After-Applying the Treatments of the Mechanisms with the Three-Cycled PLC-InTs.

Figure 2 showed that both of the general and the analytical thinking competencies of students were raised after applying the treatments of those mechanisms. The average scores of general and analytical thinking competencies were increased from 58.48 ± 20.94 to 74.71 ± 21.87 and 49.82 ± 19.99 to 68.86 ± 23.29 scores, respectively. These scores interpreted that the competency levels of students regarding to the general competencies were maintained in the ability competency with higher average score; however, the analytical thinking competencies were improved from the developing competency to the ability competency.

PLC is a significant driving force for empowering teachers, which leads to school improvement including students' competencies and achievements; besides, students learned by PLC-InTs had high intellectual learning outcomes and competencies, as well as achieved greater academic gains in Reading, Mathematics, Science and History than students who receive traditional learnings (Hord, 1997). According to Jackl (2011), schools that implemented PLC-InTs showed better classroom grade performance and higher graduation rate improvement together with higher students' competencies when compared with those that did not implement PLC-InTs.

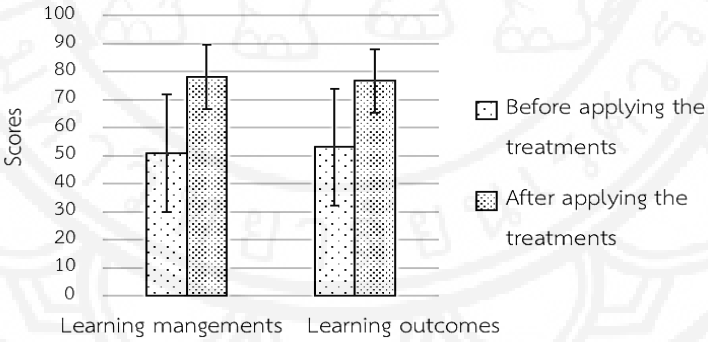

Figure 3 Competencies of Teachers between Before- and After-Applying the Treatments of the Mechanisms with the Three-Cycled PLC-InTs.

Figure 3 showed that both of the teachers' competencies of learning and classroom managements and of learning outcomes of students were raised after applying the treatments of those mechanisms. The average scores of the competencies of learning and classroom managements and learning outcomes of students were increased from 50.97 ± 14.91 to 78.06 ± 11.46 and 53.06 ± 14.05 to 76.67 ± 13.40 scores, respectively. These scores interpreted that both of the competency levels of teachers regarding to learning and classroom managements and learning outcomes of students were improved from the ability competency to the advanced competency.

PLC-InTs encourage each teacher in the PLC team to develop new learning overviews, insights, skills and competencies (DuFour et al., 2006), and InTs designed by PLC team create insights and skills of the enhancement in classroom educational process for students' betterment (Mundschenk & Fuchs, 2016). According to Jackl and Lougée (2012), teachers agreed that PLC-InTs created a positive and effective impact on teachers' performance and competency, which then extended to an academic achievement of students.

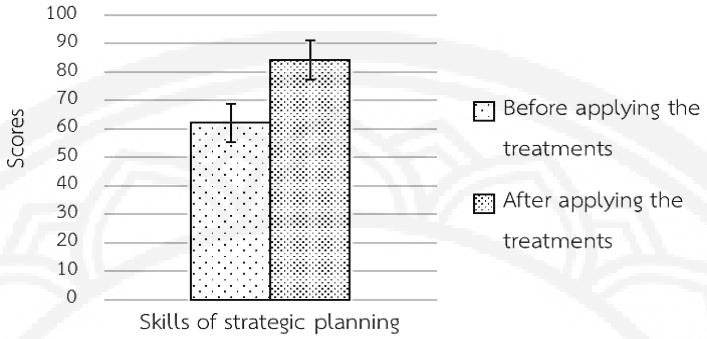

Figure 4 Competencies of Principal between Before- and After-Applying the Treatments of the Mechanisms with the Three-Cycled PLC-InTs.

Besides, Figure 4 indicated that the principal's competencies on skills of strategic planning and using administrative tools and innovations were also raised after applying the treatments of those mechanisms. The average score was increased from 62.08 ± 6.82 to 84.31 ± 6.96. These scores interpreted that the competency levels of principal on skills of strategic planning and using administrative tools and innovations were improved from the ability competency to the advanced competency.

School principal is an important component of PLC process (Buffum et al., 2009; Knight, 2012). Principal works with teachers in PLC team with mutual decisions for learning process, then real learning improvements are continuously created (York-Barr & Duke, 2004). Then, PLC created leaderships in principal and teachers, who were empowered to make decisions about instructions, lessons, interventions, learning managements, innovations and so on, which improved principal's competencies.

Conclusion and Suggestions

Professional Learning Community (PLC) incorporated with interventions (InTs) from best practices (PLC-InTs), illustrated the improvement of competencies of students, teachers and principal of Surin Phitthayakhom School, Surin Province, Thailand. All the competencies were raised after the three-cycled PLC-InTs, which is a promising strategy for whole school approach because PLC-InTs focuses on various learning managements of teachers in PLC team working together with buddy teachers, principal, academicians, and/or local experts in a continuous cycled PLC-InTs of learning in daily practices and building respectful relationships with students and those colleagues in PLC team. Then, PLC-InTs could not only raise students' achievements and competencies, but also increase teachers' and principal's competencies. PLC-InTs can be applied to other schools as whole school approach with sustainable improvement.

Acknowledgments

This research was financially supported by Teachers' Council of Thailand, Chevron Enjoy Science Project, and Southeast Asian Ministers of Education Organization Secretariat STEM Education (SEAMEO STEM-ED). We acknowledge the principal, teachers and students of Surin Phitthayakhom School, Surin Province, Thailand for participating in this research. The human research license was 0208/2564, approved by Thaksin University Research Ethic Committee.

References

Buffum, A., Mattos, M., & Weber, C. (2009). *Pyramid Response to Intervention: RTI, Professional Learning Communities, and How to Respond When Kids Don't Learn*. Bloomington IN: Solution Tree.

Bush, T., & Glover, D. (2012). Distributed Leadership in Action: Leading High-performing Leadership Teams in English Schools. *School Leadership & Management*, *32*(1), 21-36. https://doi.org/10.1080/13632434.2011.642354

DuFour, R., DuFour, R., Eaker, R., & Karhanek, G. (2004). *Whatever it Takes: How Professional Learning Communities Respond when Kids don't Learn*. Indiana: Solution Tree. Retrieved from http://egusdsecondaryed.pbworks.com/f/Whatever_It_Takes.pdf

DuFour, R., DuFour, R., Eaker, R., Many, T. W., & Mattos, M. (2006). *Learning by Doing: A Handbook for Professional Learning Communities at Work*. Bloomington, IN: Solution Tree Press.

Emihovich, C., & Battaglia, C. (2000). Creating Cultures for Collaborative Inquiry: New Challenges for School Leaders. *International Journal of Leadership in Education*, *3*(3), 225-238. https://doi.org/10.1080/13603120050083918

Gersten, R., Chard, D., & Baker, S. (2000). Factors Enhancing Sustained Use of Research-based Instructional Practices. *Journal of Learning Disabilities*, *33*(5), 445-457. https://doi.org/10.1177/002221940003300505

Hord, S. M. (1997). *Professional Learning Communities: Communities of Continuous Inquiry and Improvement*. Austin, Texas: Southwest Educational Development Laboratory (SEDL). Retrieved from https://sedl.org/pubs/change34/plc-cha34.pdf

Jackl, A. (2011). *WCPSS 2010-11 High Five Professional Learning Teams (PLT) Survey Results: Implementation Over Time*. Raleigh, NC: Wake County Public School System, Evaluation and Research Department. Retrieved from https://webarchive.wcpss.net/results/reports/2011/1103hi5plt2010-11.pdf

Jackl, A., & Lougée, A. (2012). *Wake County Public School System (WCPSS) Professional Learning Teams (PLTs): 2010-11 to 2011-12 School-Based Policy Study*. Retrieved from https://webarchive.wcpss.net/results/reports/2012/1202plt10-11sbp.pdf

Kenan Foundation Asia, Enjoy Science. (n.d.). *Chevron Enjoy Science Project: Enjoy Science*. Retrieved from https://www.enjoyscience.kenan-asia.org/Th/enjoy-science/?gclid=CjwKCAiA5Y6eBhAbEiwA_2ZWIYl_-MCq8F9GVcbzbuUH5VI3u16viWV635Ba4KxU53PywYzTaCqtDBoCe7kQAvD_BwE

Knight, J. (2012). *High-Impact Instruction: A Framework for Great Teaching*. Thousand Oaks, CA: Corwin.

McDougal, J. L., Graney, S. B., Wright, J. A., & Ardoin, S. P. (2010). *RTI in Practice: A Practical Guide to Implementing Effective Evidence-based Interventions in your School*. Hoboken, NJ: John Wiley & Sons.

Mundschenk, N. A., & Fuchs, W. W. (2016). Professional Learning Communities: An Effective Mechanism for the Successful Implementation and Sustainability of Response to Intervention. *SRATE Journal*, *25*(2), 55-64.

Rentfro, E. R. (2007). Professional Learning Communities Impact Student Success. *Leadership Compass*, *5*(2), 1-3. Retrieved from https://www.naesp.org/sites/default/files/resources/2/Leadership_Compass/2007/LC2007v5n2a3.pdf

Teachers' Council of Thailand. (2020). *Manual of Higher Education Institution for Monitoring and Evaluating the Activity of Professional Learning Community 2020*. Bangkok: Teachers' Council of Thailand.

Teachers' Council of Thailand. (2021). *Meeting Agenda of the Board of Promotion, Support, Dissemination and Exchange of Knowledge and Body of Knowledge to Develop the Depth of Educational Professions for the 1st, 14 December 2021*. Bangkok: Teachers' Council of Thailand.

York-Barr, J., & Duke, K. (2004). What do we Know about Teacher Leadership? Findings from Two Decades of Scholarship. *Review of Educational Research*, *74*(3), 255-316. https://doi.org/10.3102/00346543074003255