Examining Coaching as an Approach for Teacher Development

Gantanat Chalong[1*], Malai Tawisook[2] and Thanin Ratanaolarn[3]

[1,2,3]Doctorate Degree Candidate, Educational Management Department, King Mongkut's Institute of Technology Ladkrabang, Thailand
*Corresponding author, Email: kantanat2504@gmail.com

_____

Abstract

While there are many outside factors to be considered, teachers are the direct conduits through which we transfer knowledge, skills, attitudes and behaviors to students. It is therefore logical to target teacher professional development as a significant avenue to improve the quality of education and the level of student achievement. Coaching is becoming widespread as a means to address teacher competency and is already common in the educational systems of many academically top performing countries. This paper explores the context for professional development in education and examines the potential of coaching as a tool to improve failing educational systems such as that of Thailand's. Existing literature on teacher professional development and coaching was reviewed and analyzed to form a synthesis pertaining to the application of coaching in teacher education. The findings detail aspects and benefits of successful coaching for teachers, including the strengthening of the work culture within academic institutions, as well as evidence to support the viability of coaching as an effective and sustainable method for enhancing teacher readiness and supplementing teacher retention. Coaching can greatly assist teachers to adopt and continually develop critical skills and is a worthwhile alternative for struggling educational systems to improve their effectiveness.

Keywords: coaching, professional development, teacher competency

_____

บทคัดย่อ

แม้จะมีปัจจัยภายนอกหลายประการที่เข้ามาเกี่ยวข้อง แต่ครูมีบทบาทโดยตรงในการส่งผ่านความรู้ ทักษะ ทัศนคติและพฤติกรรมต่าง ๆ ให้แก่นักเรียน นี่จึงเป็นเหตุผลที่สำคัญว่าจำเป็นต้องพัฒนาครูให้เป็นมืออาชีพ เพื่อจะได้เป็นเส้นทางสู่การปรับปรุงคุณภาพการศึกษา และพัฒนา ผลสัมฤทธิ์ของนักเรียน ระบบโค้ชจึงได้รับความนิยมนำมาใช้กันอย่างแพร่หลายในการพัฒนาสมรรถนะครูของประเทศที่ประสบความสำเร็จสูง ในการจัดการศึกษา จากการศึกษาครั้งนี้เป็นการสำรวจเกี่ยวกับการพัฒนาครูสู่มืออาชีพและการศึกษาศักยภาพของระบบโค้ชในการเป็นเครื่องมือยก ระดับการศึกษาดังเช่นที่ประเทศไทยประสบอยู่ โดยศึกษาวิเคราะห์และสังเคราะห์เอกสารที่เกี่ยวข้องกับระบบโค้ชที่ใช้ในการพัฒนาครู ผลการศึกษา ทำให้ได้รายละเอียดเกี่ยวกับลักษณะการโค้ชและการโค้ชครูให้ประสบความสำเร็จรวมถึงการทำให้เกิดเป็นวัฒนธรรมคุณภาพในสถานศึกษาและมี หลักฐานที่สนับสนุนว่าการโค้ชส่งผลให้ครูมีความพร้อมในการปฏิบัติงานมากขึ้น และยังสามารถรักษาครูไว้ได้อย่างยั่งยืน ระบบโค้ชเป็นเครื่องมือ ที่สุดยอดในการช่วยให้ครูพัฒนาศักยภาพอย่างเป็นระบบและต่อเนื่องอย่างดียิ่ง และเป็นทางเลือกในการพัฒนาประสิทธิภาพของระบบการศึกษา

คำสำคัญ: การโค้ช การพัฒนาครูสู่มืออาชีพ สมรรถนะครู

_____

1. Introduction

As societal, cultural and technological changes become ever more rapidly changing, education has struggled to keep pace and calls for amendments, reforms or, in some cases, even outright revolution have become the norm in the demand for improved student performance.

Educational outcomes are the result of many factors, of which the most significant is the teacher. Directly through teachers, not only knowledge but also habits and attitudes are transferred to students. It is essential that teachers are knowledgeable and can proficiently communicate that knowledge, as well as offer encouragement to their students and strive to seek self-improvement opportunities for themselves (Sritai, Anantaluk & Amornpun, 2012).

Among teachers, there are a number of variables that influence effectiveness, including years of experience, academic credentials, areas of expertise and so forth, but most consequential is the nature of teaching and its application in the classroom. Harold Wenglingsky's analysis into individual factors affecting student outcomes found that professional development for teachers was especially significant, as

students taught by teachers who received professional development saw greater degrees of success in their studies than those who were not (Wenglingsky, 2000).

A development technique that has already existed in many other fields, coaching is gaining popularity as a professional development tool aimed at improving teacher competency. Through coaching, student achievement can be enhanced by improving teachers' knowledge, practices, confidence and attitudes (Cornett & Knight, 2009).

The terms "mentoring" and "coaching" have often been mistakenly understood to be interchangeable, but there exist significant differences between the two. Mentoring is a process of support; novices are guided by more experienced mentors through the particulars of a new practice or profession, helping them to acclimate themselves to their new roles and responsibilities. Coaching is similar to mentoring in that it is a system wherein one party receives support from another party, sometimes one more expert or experienced, sometimes one of peers. However, coaching is a developmental process that is more structured than mentoring and aims for improvement in targeted skills and achievements. Coaching has less of an apprenticeship aspect than mentoring, and knowledge and skills can be acquired from a number of expert sources as opposed to a single mentor (Hughes, 2010). The coaching process focuses on specific areas of performance and its outcomes are expected within predetermined, finite timeframes. The process has been mutually beneficial for coaches and coachees, the parties being coached, as gains can be seen not only in professional skills but also in efficacy, attitudes and relationships (Lord, Atkinson & Mitchell, 2008). As such, this is not much different from athletic coaching, which is teaching that is not just through *telling* but also through *showing*; that is, the demonstration and cultivation of an understanding of *why* things are, not just *what* or *how* they are. The deeper understanding of causes, rationales and consequences allows for better mastery of content and in turn improves understanding, and ultimately achievement, on the part of students (Russo, 2004).

While the mentoring agenda is dictated for the most part by the learner's career and personal growth, the coaching agenda is set by the coach with the goal being that of skill enhancement, which can be accomplished both one-to one and in groups (Garvey, 2004). The nurturing nature of mentoring is also evident in its components: the interests and needs of the novice are identified, the novice freely volunteers for the process, the novice is matched with a compatible mentor and the novice receives support from the mentor until independence is gained. This is in contrast to the coaching cycle, wherein specific skills are identified to be refined or enhanced, and then a plan is implemented for the coaching to do so through structured interventions. This can be accomplished through myriad avenues of instruction, challenges and stimulation but necessary to coaching is much analysis, reflection and review (Gallacher, 1997).

It is the nature of how teachers teach that must be changed, from training, to preparation, to practice, to evaluation. With coaching not only are professional relationships fostered, but roadmaps can also be formulated and followed, given the targeting of specific issues to be solved in sequence. There are many types of coaching, for example peer coaching where colleagues help guide each other, cognitive coaching where thought processes and comprehensions are stressed, literacy coaching where support is given in daily work, and instructional coaching where concepts or techniques are modeled for coachees. These different approaches are borne out of different needs and have differing applications but they all serve to improve teacher competency, which studies have shown to positively impact student achievement (Cornett & Knight, 2009).

In fact, what the various approaches to coaching have in common is that they all have a focus on professional practice, which is meant to improve how students are taught; all are job relevant, developing skills and techniques directly applicable in the classroom; and all are ongoing, which fosters and strengthens what is learned over a period of time (Knight, 2009).

Instructional coaching, where coaches teach and model successful techniques and behaviors for coachees, is the most basic and familiar coaching approach, but peer coaching is also easily implemented and cost effective. With peer coaching, a collaborative and inclusive network among teachers can be built, as this approach is based on using existing staff as support systems for one another. While it is true that they work in a crowded environment, teachers are usually isolated from one another in terms of both location and time. This can be countered by creating a system where groups of teachers can together identify, address and experiment with different issues and offer feedback and support to one another (Robbins, 1991).

Peer coaching is a collaborative effort; it develops a shared language, common understandings and a professional development system that, through reducing risk by increasing numbers; not only encourages teachers to try new techniques, but also has a built-in follow up structure in the sense of community formed among teachers by forging these relationships (Showers, 1985).

Very often, teacher quality and competency are kept at a high standard in academically successful countries with help from coaching. In Singapore, whose educational system is considered a model of quality not only in Southeast Asia but globally, and where quality teachers are highly regarded, novice teachers are expected to learn their craft from senior teachers who act as coaches and help induct beginner teachers into the profession (Darling-Hammond & Rothman, 2011). Ample time and resources are dedicated to the induction of new teachers and development activities such as coaching are a mandatory requirement in countries such as Australia, France, Greece, Israel, Italy, Japan, Korea, New Zealand and Switzerland. Top ranked nations in academic success recognize that the preparatory stage of teacher development is essential. Resources must be devoted to making teachers as well-prepared as possible, right from the beginning. Funding, oftentimes at government expense, is given not only for content learning and training, but also for living expenses and release time for observations. Graduate level teaching preparation and living stipends are federally paid for in Finland, Sweden, Norway and the Netherlands. In New Zealand, beginning teachers receive 20 percent paid release time for observations or other professional development activities. South Korean teachers spend only 35 percent of their working time in the classroom, with the remaining time spent in shared offices where they share ideas and resources, which is conductive to inducting new teachers. Teachers in Japan and Singapore also have the majority of their time dedicated not to classroom instruction, but to preparation, further professional development and assessment. Beyond the preparatory stage, continuing education to maintain and improve teacher competency is also compulsory in the aforementioned countries (Darling-Hammond, Chung-Wei & Andree, 2010).

In the United States, professional development for teachers in the form of coaching has been implemented in many schools across the country. Public schools in New York City have assigned coaches tasked with helping teachers with both planning and technique. Coaches not only met with teachers in small groups to aid with their lesson preparation, but also demonstrated sample lessons for teachers to observe. In Philadelphia, a pilot program where individual coaches were assigned to work in each school part-time was so well received that the following year a professional development program was implemented for 500 educators, using 130 coaches. In Texas, funds were solicited to subsidize staff developers to act as coaches in schools. Within five years, all involved schools utilizing coaches for teacher development saw student literacy greatly improved and were soon removed from the state's listing of low-performing schools (Russo, 2004).

2. Objectives

The state of Thailand's educational system is considered to be very poor and a multitude of quick-fix solutions implemented by the central government have failed year after year. This study examines the impacts of coaching on education and its stakeholders to help illuminate its potential as a system that can act as a viable approach to develop and maintain teacher competency, a significant factor in academic success.

3. Materials and methods

This paper is a review of existing literature on coaching as it pertains to education in general and teachers in particular. Findings were analyzed and compared to form a general synthesis of information about coaching, its details, applications and benefits.

4. Results

Successful education aims not only to give students information but also to cultivate critical and creative thinking. Quality teaching enables students to grow beyond simply recycling facts to understanding the reasons behind and ramifications of the content they are taught. Two subjects from which we can ascertain this level of aptitude are mathematics and science, since both require problem solving and

deduction. On a practical level, mathematics and science both permeate our everyday lives and are critical to advancements on individual, societal and global scales.

Having a firm grasp of mathematics and its concepts is conducive to the improvement of skills such as reasoning, planning, analysis, decision-making and problem solving (Makanong, 2010), and enhances rational thinking and inventiveness (Kunpaluek, 2014). Mathematical proficiency also facilitates learning in other fields of study. The same can be said for science, as science competency improves thought processes and also promotes reasoning, analysis, systematic problem solving and informed decision-making. As these subjects tend to be abstract, it is within the purview of the teacher to find a way to communicate them to students clearly. Tangible connections need to be made between abstract concepts and practical applications that would be meaningful in students' lives. Quality teaching can achieve these goals and it is here where evidence can be found regarding the importance of teacher competency.

Properly endowing students with tools and know-how to master a subject makes more likely their participation and inspires preparedness and initiative. Instead of waiting to be told what to learn and what to do, a motivated class of students will make use of time both in and out of the classroom to seek out deeper, clearer understanding of material. Students of effective teachers are actively engaged in their education and ready to learn (Jareeyawittiyanon & Sriwattanatumma, 1990). The sense of being invited stakeholders infuses students with enthusiasm, discipline and motivation. Instead of having to be coerced to learn, they have the necessary knowledge and experience to be "in on the joke" and the more involvement they have, be it in planning, decision-making, organizing, or evaluating, the more responsibility they will show and the more interest they will have in the subject matter (The Institute for the Promotion of Teaching Science and Technology, 2012).

Thai students, conversely, nearly without fail require their teachers to tell them what to do and to provide them answers; lacking the ability to think critically or to solve problems on their own, most are catatonic when not supplied with explicit instructions. This is the result of a tendency in Thailand to rely on rote instruction instead of teaching processes that make use of active learning. Thai students score consistently low on Thailand's annual standardized exam, the O-NET, which is taken every year by all primary six, secondary three and secondary six students in the country. Because their teachers adhere to antiquated and ineffective notions, few students reach desired achievement levels in mathematics and science, as there is a failure on teachers' part to properly communicate concepts.

It is not only the quality of teaching that affects students' mathematics and science proficiency, as Thailand has a shortage of teachers and researchers graduating from these fields (Thairath, 2014). Between 2003 and 2005, there were only 250,000 graduates with a Bachelor's degree in mathematics or science and only 100 graduates in those fields receiving a master's degree (Charoenwongsak, 2007).

On international assessments, Thailand's students perform poorly as well. While many Asian countries have demonstrated consistent outstanding achievement in the Organization for Economic Co-Operation and Development's Programme for International Student Assessment (PISA), Thailand has continually scored well below average and in the past ten years has not shown much improvement. Thailand's performance in the Trends in International Mathematics and Science Study (TIMSS) has also been similarly disappointing.

One problem surely not a primary factor in Thailand's dismal state of education is finances because the country invests financial resources into education that are proportionately larger than that of most other comparable countries (Corcoran, 2015). Therefore, the problem evidently dwells within the realm of human resources and educational practices, specifically teachers and how they teach. Thai teachers must break away from antiquated, ineffectual practices and habits, and be trained how to engage their students' interest (Thailand Development Research Institute, 2012).

Thailand's close neighbor, Singapore, stands tall in the international community as a shining example of quality teaching. The important role that mathematics plays in the development of their economy is recognized, as well as the role of the teacher and the significance of quality teaching, so there is great emphasis in ongoing teacher training in the national curriculum. Students perform especially well in math, accomplished through teachers who make mathematical concepts visually tangible to students. Mathematics teachers in Singapore are well trained in the use of model drawing, which helps students "see" problems and equations. The mathematical problems students in Singapore solve can be, and generally are,

more complex than those being taught to their peers in the west, mainly due to the country's focus on teacher training (Cavendish, 2015).

Rewards in Singapore are bestowed based on merit and achievement, not longevity or wealth or status and the country's systems for training and maintaining teachers are of the most comprehensive worldwide, so its educational system is able to attract and retain the best candidates available. Teachers are well trained from the beginning but also receive coaching early in their careers and receive opportunities based on their potential. Much funding is also allocated to make being in the teaching profession financially sound, which is a significant factor in teacher retention (Sclafani, 2008).

From the above example we can see that coaching, while a powerful tool, exists as part of a system to improve education. It is not a solitary, magical solution that alone will fix all the problems inherent in teaching and learning. However, with the proper ancillary support and sufficient dedication and time, the benefits from coaching are notable and sustainable (Russo, 2004).

To maximize gains, attention must be paid to the selection of the teachers who will be coached. Teachers will either regard coaching as an opportunity for self-improvement or regard the process as a burden. In one study, six coaches were selected to assist eighteen Canadian history teachers in the implementation of new history curriculum guidelines. In addition to curriculum materials and a series of half-day workshops, teachers were given access to coaches both face-to-face and via telephone although the coaches did not observe teachers in their classrooms, and in only two instances did coaches teach a demonstration lesson for a coachee to observe. Assessment was based on teacher reports and classroom documents. Results revealed that the more teachers were receptive to the coaching, the more positive was the impact gained from that coaching and students who studied under coached teachers performed better than students of teachers who were not coached. Managers needed to play an appropriate role in the process since undue interference and poorly defined roles and procedures may be a hindrance. While coaches can positively affect the attitude, thinking and feelings a teacher has about teaching, improve teachers' performance, and make them more confident and effective in helping students reach established goals, coaching should be ongoing and progressive in order to be optimally effective (Ross, 1992). Professional development is a process with many steps, not a single, self-contained event, as coaches and coachees need time to continually work and experiment with how to effectively solve specific problems (Loucks-Horsley, 1987).

5. Discussion

Teachers develop their individual pedagogies and styles early on, and it is important to guide beginning teachers so as to prevent the growth of bad habits. Traditional methods of professional development, such as seminars, lectures and workshops, may offer useful information but coaching is a necessary supplement because simply receiving theories from isolated presentations leads to at best 10% implementation of said theories in the classroom (Moffett, 1987). This is because these traditional methods of training occur outside of the setting where teachers actually work, their classrooms, and forces them to transfer what they learned into a different environment with different variables. Coaching can ease this process, either by taking place in an actual instructional setting through demonstration or by coaches being regularly available to aid teachers in how to effectively apply strategies and techniques to their everyday teaching. A coach's ability to be "hands-on" and deliver follow-up is crucial. In a case study wherein instructional coaches were assigned to support teachers in a northwestern American school district, a teacher who received adequate follow up from an experienced instructional coach found more success in implementing the skills acquired from coaching than she did the previous year when she was assigned a less attentive coach. The more effective coach tailored professional development activities, assisted with lesson plans and materials, provided both demonstration and observation, and, importantly, was "hands-on" with one on one coaching, which in turn facilitated growth and reflection (Chien, 2013).

Oftentimes training itself can alienate teachers. Beyond thinking of training as a burden and increased workload, unsuccessful training can adversely affect enthusiasm and commitment. Teachers will assume that it is a foregone conclusion that training will be ineffective or receive no follow-up support. In this way, coaching is far more effective than traditional approaches that are limited by time or scope. The seminar or lecture model, wherein an expert addresses a group of strangers in a room, can actually cause

more harm than good as adults, even when they do not have answers themselves are not very receptive to being lectured or made to feel inferior. Workshops offer a more communal experience, but they too are limited to a very short timeframe during which a skill may be introduced, but not mastered. In order to change how a person behaves, time is needed for that person to ingest, process and become familiar with new ideas and practices, usually with much trial and error. A coaching system, by contrast, becomes a constant that teachers can rely on to learn, amend and master new ideas and practices. Coaches themselves must also find a way to to fit into the school environment and define their roles. It is important to build collaborative, but professional not personal, relationships and win over the teachers who are to be coached. Successfully navigating these variables and understanding that coaching is a gradual process is also important. An instructional coach at Bohemia Manor School in Maryland, USA, in her first year as an instructional coach at the institution, was able to lead the school's teachers in doubling math and reading proficiency in students. Furthermore, Bohemia Manor School was the only school in its district to have the majority of its students proficient across all subjects at every grade level. The following year, she helped the school make even more academic gains. With an instructional coach on-site, teachers had a valuable and readily available resource for their professional development (Knight, 2007). With enough time, teachers can detach themselves from ineffective yet familiar routines and then let newer, better ones take root until they become familiar habits that can be automatically performed. This transfer and acclimation is suited for systems that employ coaching, and simply cannot be achieved within the timeframe or parameters of other more traditional types of professional development (Joyce & Showers, 1982). Past efforts have proceeded on the incorrect assumption that teachers can learn off-site, return to a different environment and simply implement what they have only tangentially learned and rarely had the opportunity to practice and reflect upon. Coaching does not only teach alternative approaches, it focuses on individual coachee's own needs and attitudes over time, making the transfer of skills after initial training far more likely (Showers & Joyce, 1996). It is this transfer of skills that illustrates the effectiveness of coaching, and the quality and sustainability of the skills acquired or learned is an important consideration. There would be little point to any development activity if what is acquired had little value or were eventually abandoned. With many traditional, short-term development activities such as one-time workshops or seminars, teachers showed a tendency to discontinue use of newly acquired skills after some time. Compared to uncoached teachers, teachers who were coached were more apt to adapt themselves to be more open to and adopt new, potentially more effective methodologies. Because of its ongoing, interpersonal and reflective nature, coaching positively affected transfer of knowledge and skills and enhanced teachers' comfort with their material and their efficacy (Showers, 1982).

As the process fosters relationships between individuals, another benefit of coaching is increased dialogue, and therefore sharing of and reflection upon ideas. Coaching is not an evaluative exercise, but rather a system in which teachers are not alone to deal with the requirements and pressures of their job. Also, in a non-judgmental environment, teachers feel free to try new ideas and practices (Lieberman, 1995). It is important to remember that the essence of these endeavors should be that of assistance, not blame. However, teachers have a tendency to not seek out help unless it is required, which is why a mandated coaching system is more suitable to solving specific problems while a voluntary mentoring system may be more appropriate in matters of general guidance. With coaching, we can identify specific problems, determine how to reach solutions to these problems, integrate new teachers into new social systems, and hopefully increase teacher retention (Gonzales & Sosa, 1993).

The coaching relationship can also act as an example for teachers in how they interact with their students. A study of coaching for teachers in a number of New Zealand schools found that, after experiencing model interactions through coaching, teachers saw improvement in their relationships with their students, who in turn also demonstrated increased motivation. The students became more engaged and enjoyed greater participation in their learning as a result of their teachers being coached to have clarity of purpose and to foster positive relationships of inclusion (Hawk & Hill, 2003).

6. Conclusion

From the evidence available, the implementation of a coaching system is an effective way to help teachers adopt new approaches and continually develop their skills and practices. While teachers improve themselves, students, coaches and schools also stand to gain positive returns from coaching. Admittedly, students have seen varying levels of success as a result of teachers being coached and more research is needed to cover the now vast applications of coaching worldwide, but from most evidence greater levels of achievement were seen from students whose teachers had received coaching. The coaching process must also be adequately supported by school administrators, particularly principals, in order to flourish. As observed in a study of content-focused coaching, a principal's endorsement demonstrates to teachers the value of the coaching process in general and the coach in particular. A direct correlation was seen between this administrative support and teacher participation, as teachers were more likely to utilize and heed a coach whom their principal champions. Logistical support for coaching must also be demonstrated by principals, as time for activities needed to be allocated and access to classrooms granted. The principal, however, must understand and observe delineated roles and take care not to impede a coach's autonomy, asserting control or evaluation when it is inappropriate (Matsumura, Sartoris, Bickel & Garnier, 2009). Stakeholders must recognize areas that need to be dealt with, accept the requirements and ingrained workplace cultures of their institutions, set reasonable expectations for coaching, be knowledgeable about what it involves, dedicate the time and resources it requires and rally the commitment of staff, but there are many considerable benefits to be gained from coaching. Coaches themselves gain in knowledge and skills acquired during the coaching process and institutions stand to gain a sustainable culture of increased collaboration and professionalism (Lord, Atkinson & Mitchell, 2008). Thai education is in dire need of a viable system with which to improve its effectiveness, and while understanding needs to be fostered and much effort given, the sustainable results offered by coaching make it a viable option.

7. Acknowledgements

8. References

Cavendish, M. (2015). Problem solving in Singapore math. Retrieved May 28, 2015, from http://www. hmhco.com/~/media/sites/home/education/global/pdf/white-papers/mathematics/elementary/math-in-focus/mif_problem_solving_paper_lr.pdf?la=en

Charoenwongsak, K. (2007). Improving science and mathematics… a big difficult task. Retrieved June 21, 2015, from http://www.vchargarn.com/varticle/33141

Chien, C.W. (2013). Analysis of an instructional coach's role as elementary school language teachers' professional developer. *Current Issues in Education*, *16(*1), 1-8.

Corcoran, T. (2015). Summary of discourse on improving science teaching. Retrieved June 21, 2015, from http://www.scribd.com/doc/105791966/สรุปประเด-นการบรรยาย-Improving-Science-Teaching

Cornett, J. and Knight, J. (2009). Research on coaching. *Coaching: Approaches & Perspectives* (pp.192-213). California: Corwin Press.

Darling-Hammond, L.; Chung-Wei, R. and Andree, A. (2010). *How high achieving countries develop great teachers.* California: Stanford Center for Opportunity Policy in Education.

Darling-Hammond, L. and Rothman, R. (2011). Lessons learned from Finland, Ontario, and Singapore. *Effectiveness*, *1*(1), 6-54.

Gallacher, K. (1997). Supervision, mentoring and coaching. *Reforming personnel in early intervention* (pp.191-214). Maryland: Paul H. Brookes Publishing.

Garvey, B. (2004). The mentoring/counseling/coaching debate: Call a rose by any other name and perhaps

it's a bramble? *Development and Learning in Organizations: An International Journal*, *18*(2), 6-8.

Gonzales, F. and Sosa, A. S. (1993). How do we keep teachers in our classrooms? The TNT Response. *Idra Newsletter*, *1*(1), 6-9.

Hawk, K. and Hill, J. (2003). Coaching teachers: effective professional development but difficult to achieve. *Prepared for the AARE/NZARE conference*, 3-15.

Hughes, S. (2010). Mentoring and coaching. *How to be a brilliant mentor: Developing outstanding teachers* (pp.95-102). London: Routledge.

The Institute for the Promotion of Teaching Science and Technology. (2012). Educational management that promotes learning efficiency. Retrieved June 21, 2015, from https://kanchit004.wordpress.com/บทความ-2/การจัดการเรียนรู้ที่ส/

Jareeyawittiyanon, P. and Sriwattanatumma, I. (1990). Mathematics and national development. *The Journal of The Institute for the Promotion of Teaching Science and Technology*, *18*(2). Retrieved June 21, 2015, from http://www.school.net.th/library/snet2/paper/math_develop.htm

Joyce, B. & Showers, B. (1982). The coaching of teaching. *Educational Leadership*, *40*(1), 4-10.

Knight, J. (2007). *Instructional coaching: A partnership approach to improving instruction*. California: Corwin Press.

Knight, J. (2009). Coaching. *Journal of Staff Development*, *30*(1), 18-22.

Kunpaluek, T. (2014). Study the learning process of teachers and students that learning mathematics in secondary school for contributes the 21st century people's skill with coaching system. Research. Phetchabun Rajabhat University.

Lieberman, A. (1995). Practices that support teacher development: Transforming conceptions of professional learning. *Innovating and Evaluating Science Education: NSF Evaluation Forums*, *1992-94*, 67.

Lord, P.; Atkinson, M. and Mitchell, H. (2008). *Mentoring and coaching for professionals: a study of the research evidence*. UK: National Foundation for Educational Research.

Loucks-Horsley, S. (1987). *Continuing to learn: A Guidebook for teacher development*. USA: National Staff Devlopment Council.

Makanong, A. (2010). Mathematical skills and processes: develop for development. Research. Chulalongkorn University.

Matsumura, L.C.; Sartoris, M.; Bickel, D.D. & Garnier, H.E. (2009). Leadership for literacy coaching: The principal's role in launching a new coaching program. *Educational Administration Quarterly*, *45*(5), 655-693.

Moffet, K. (1987). Training and coaching beginning teachers: An antidote to reality shock. *Educational Leadership*, *44*(5), 34-37.

Robbins, P. (1991). How to plan and implement a peer coaching program. Retrieved September 28, 2015, from http://www.ascd.org/publications/books/61191149/chapters/A-Definition-of-Peer-Coaching.aspx

Ross, J. (1992). Teacher efficacy and the effects of coaching on student achievement. *Canadian Journal of Education*, 51-65.

Russo, A. (2004). School-based coaching. *Harvard Education Letter*, *20(*4), 1-4.

Sclafani, S. (2008). *Rethinking human capital in education: Singapore as a model for teacher development*. Maryland: Aspen Institute.

Showers, B. (1982). Transfer of training: The contribution of coaching. Retrieved May 22, 2016, from http://files.eric.ed.gov/fulltext/ED231035.pdf

Showers, B. (1985). Teachers coaching teachers. *Educational Leadership*, *42*(7), 43-48.

Showers, B. & Joyce, B. (1996). The evolution of peer coaching. *Educational Leadership*, *53*(1), 12-16.

Sritai, W., Anantaluk, M. and Amornpun, S. (2012). Competency of secondary science teachers competency and the outlook of upper secondary students. *The Journal of The Measurement of Educational Results, Mahasarakham University*, *17*(1), July 2012. Retrieved June 21, 2015, from http://edu.msu.ac.th/jem/home/journal_file/261.pdf

Thailand Development Research Institute. (2012). Much learning, but low scores. Retrieved May 28, 2015, from http://www.qlf.or.th/Home/Contents/247

Thairath Online. (2014). Analyzing o-net scores. Retrieved May 15, 2015, from http://www.thairath.co.th
        /content/413042

Wenglingsky, H. (2000). *How teaching matters: bringing the classroom back into discussions of teacher
        quality*. New Jersey: Educational Testing Service.