Thinking Maps: Research-Based Instructional Strategy in a PDS

Cristy Kessler, University of Hawaii
Deborah K. Zuercher, University of Hawaii
Caroline S. Wong, Moanalua Middle School

ABSTRACT: An exploratory action research case study was conducted at Moanalua Middle School from 2006–2009 to examine the impact of Thinking Maps on student achievement. Thinking Maps are not just another set of graphic organizers but a set of eight of unique visual mind maps with each linked to a specific higher-order thinking pattern. This study tells the story of one middle school where a school-wide initiative demonstrated an increase to 86% grade-level reading proficiency within three years.

NAPDS Essential(s) Addressed: #1/A comprehensive mission that is broader in its outreach and scope than the mission of any partner and that furthers the education profession and its responsibility to advance equity within schools and, by potential extension, the broader community; #2/A school–university culture committed to the preparation of future educators that embraces their active engagement in the school community; #3/Ongoing and reciprocal professional development for all participants guided by need; #4/A shared commitment to innovative and reflective practice by all participants; #5/Engagement in and public sharing of the results of deliberate investigations of practice by respective participants

Background

The challenges facing public schools today oftentimes seem impossible to overcome as faculty and staff attempt to address the needs of different learners in every classroom. "Public schools desperately need teachers who can purposefully create a positive and caring culture in the classroom; utilize instructional strategies and an engaging curriculum relevant and important to students and their community; facilitate strategic reading and thinking skills; and use assessments to inform instruction" (Kessler & Wong, 2008, p. 70) One of the biggest issues

for K-12 members of professional development school (PDS) sites is that their university counterparts "often conduct studies on topics that do little to help schools solve problems such as how to train teachers, how to raise skills, how to lower dropout rates and whether smaller classes really make a difference" (Toppo, 2007, p.1). The PDS partnership between the University of Hawaii and Moanalua Middle School set out to change that mindset. For this article we have joined together to collect relevant data and analyze the impact of one research-based practice, Thinking Maps, on two major ideas that have become strong and powerful in our PDS

partnership. Individually, and in partnership, our goals for our PDS were

1. To develop highly qualified teachers who would positively impact student learning.
2. To employ research-based practices so that everyone in the learning community is simultaneously teacher and learner.

These goals are not linear; rather they continue to intersect and assimilate. Whether collaboratively planning an agenda, problem solving a difficult personnel decision, or strategizing professional development for pre-service or in-service teachers, we discovered that no matter what the conversation topic was, our touchstone was always a shared commitment to two essential goals that were at the heart of it all (Kessler & Wong, 2008).

According to the American Educational Research Association (AERA), teacher education programs that incorporate collaborative partnerships between university programs and local schools have a positive effect on student achievement (NCATE, 2006). The university's Master of Education in Teaching Program, MEdT, is a two-year program for students who already possess a baccalaureate degree in the arts or sciences. It is a field-based, learner-centered program focused on using inquiry, reflection, and collaboration to support the success of future classroom teachers. While fully immersed in the school setting for all four semesters, MEdT students teach, learn, and reflect on practice with veteran teachers and mentor teachers at Moanalua Middle School. Moanalua Middle School serves a diverse socioeconomic and ethic population of 860 seventh and eighth graders (about one-third of them military dependents). According to recent student profile data, 45% of the student population is Asian, 25% White, 9% Pacific Islander, 6% Black, and 15% other. About 8% of the student body receives Special Education services and 5% receive English as a Second Language (ESL) services. The relationship between Moanalua Middle School and the university is essential to the success of the MEdT program.

The stakeholders in this PDS partnership were comprised of a university professor, mentor teachers, a site coordinator, a principal, MEdT pre-service candidates, and veteran teachers. Once a month these stakeholders came together at the Executive Council. Freese (2004) describes the unique structure of governance of MEdT when she describes the Executive Council, which is the council that meets monthly to provide an effective means of communication, collaborative decision making, and formative assessment of progress to achieve the shared goals of the program. This governance structure includes all stakeholders working together and actively engaged in planning, teaching, inquiry, and decision making to strengthen practice at all levels. It is this very structure that not only allowed MEdT and MMS to communicate in a formal and regularly scheduled manner, but also supported the sharing of successes and best practice within the learning community.

The partnership between Moanalua Middle School and MEdT was created using the vision of Roland Barth (1990). Barth talks about a community of educators as learners in which all components support one another through open and on-going dialogue, peer-to-peer observations, sharing knowledge of their craft, and actively collaborating to help one another become more skillful teachers. This concept of a learning community framed the PDS model used between the university and Moanalua Middle School. Together we supported the MEdT and pre-service teachers simultaneously with professional development in a public middle school setting. Like teaching hospitals in medicine, the school aims to provide a site for state-of-the-art practice that is also organized to support the training of new professionals, extend the professional development of veteran teachers,

and sponsor collaborative research and inquiry (Darling-Hammond, 2000).

The stakeholders in the PDS wanted this learning community to reflect the concept of holonomy described by Costa and Garmston (2002) as a phenomenon with the dual characteristics of being both a part and a whole at the same time. "Holonomy looks at both our independent and interdependent tendencies; i.e., being the best that I can be as an individual and reflective learner…and being the best that I can be as part of a team, partnership, or learning organization" (Costa & Garmston, 2002, p. 19). A holonomous partnership continually looks for areas of growth for all stakeholders in the learning community, so that individuals become independent and self-actualizing while functioning and growing interdependently (Kessler & Wong, 2008). The PDS partners created productive, collaborative relationships; respect of individual differences and needs; and recognition of their own personal contribution to the growth and development of the learning community, regardless of role and position. This vision was grounded by essentials that included ongoing and reciprocal professional development for all participants guided by need and a shared commitment to innovative and reflective practice. The stake holders believed that if educators have the training, skills, resources, and will, they can overcome barriers to student learning and positively impact achievement for all students.

Structures That Support Our PDS

As the two goals began to take shape for our partnership, it was imperative that structures currently in place at Moanalua Middle School and in the MEdT program were aligned. *Structure* refers to school and MEdT program organizational and work groups, the commitment of specific personnel, time, or other resources, and school or program expectations, requirements, practices, and processes. What pre-service teachers did for required

university coursework needed to be directly linked to what they were observing and doing in the field. We worked to bridge the gap between theory and practice for the entire learning community and use the structures at the school and in the MEdT program to support the goals of our PDS.

MEdT Structures. All of the courses taught in the MEdT Program were held on-site in our partnership middle school. The university professor worked closely with the principal and site coordinator to ensure all seminars integrated research and instructional practices, which were the same as those that actively engage classroom teachers in the school. For example, MEdT students are grounded in standards-based lesson planning as well as strategies to differentiate instruction, address multiple intelligences, and integrate metacognitive reflections to strengthen learning. Assessments focus on critical thinking, problem solving, and application to real-life situations, and may involve service learning. The main instructional strategy that encompasses all of these is Thinking Maps. At the same time the seminars were being presented to the pre-service teachers, the faculty at Moanalua Middle School received training in Thinking Maps through team planning. Based on this model, when pre-service teachers work collaboratively with in-service teachers, they can develop a shared knowledge and language that focuses on improved teaching and student learning. The language and instructional strategies being spoken between all stakeholders is the same.

In addition to weekly seminars and electives, MEdT students must also complete five program requirements. These include (1) a school portrait; (2) a lesson study; (3) a case study; (4) a Master's thesis or alternative project; and (5) a teaching portfolio. Thinking Maps can be found in all aspects of these five program requirements; Thinking Maps were also used as a teaching tool by the university professor in weekly seminars.

Moanalua Middle School structures. Moanalua Middle School (MMS) has innovative structures in place to support quality professional devel-

opment of its in-service teachers. These structures also make MMS an ideal place for the MEdT students to learn the profession of teaching and research-based instructional practices to improve student achievement. Two of the unique structures implemented at MMS included (1) interdisciplinary teaming and team planning time; and (2) staff development through team planning. These two areas strengthened the learning of Thinking Maps by all faculty and administrators. Through the team planning process, the principal and university professor were also able to study the effects of Thinking Maps on student learning at MMS. The principal, teacher leaders, and on occasion, the university professor, met during planning time to provide focused support that was specific to their students and professional development needs. This time provided opportunities for small group shared learning and mentoring for in-service and MEdT pre-service teachers related to research-based best practice. Thinking Maps (Hyerle & Yeager, 2007) is one example of a school-wide, research-based practice implemented over a two-year period.

Thinking Maps as an Instructional Strategy

Since our challenge was to incorporate research-based practice in our pre-service and in-service teaching, we turned to the extensive research identifying essential instructional strategies that make a significant difference in student learning. We investigated the meta-analysis of Marzano, Pickering, and Pollock (2001), who analyzed studies on K-12 instructional strategies. They identified nine instructional strategies that have a high probability of enhancing achievement for all students in all subject areas in all grade levels.

Thinking Maps was the instructional strategy pattern used in the PDS that incorporated the nine instructional strategies identified by Marzano et al. (Figure 1). There are eight distinct Thinking Maps that employ unique visual mind maps linked to specific higher-order-thinking. "Thinking Maps are eight fundamental thinking skills defined and animated by maps and introduced as a common visual language for thinking and learning across whole learning communities" (Hyerle, 2004, p. 2). By correctly identifying and using Thinking Maps, teachers can build clear, concise, and consistent higher-order-thinking patterns (Table 1) for learners in their classrooms (Thinking Maps Incorporated, 2009). Thinking Maps act as a language of visual tools that exemplify equity in access to higher-order thinking tools for every student on the journey of lifelong learning (Hyerle, 2004, p. 5).

Thinking Maps are not be confused with graphic organizers. Graphic organizers can take on many different shapes, designs, and thought processes. Although both Thinking Maps and graphic organizers are non-linguistic representations, graphic organizers promote student activity but Thinking Maps support representations of an actual thought process. Hyerle (2005) identifies over 400 different graphic organizers in the world. Students may come up with the correct answer using any type of visual representation, but without a Thinking Map, students generally lack a clear understanding of the thought processes that led them to the answer. The eight specific thought processes of Thinking Maps can be found in Figure 1.

There is an assumption at both the university level and in most schools that there truly is a commitment to research-based practices and a willingness to change the way we teach. Few university faculty members focus on research-based practice in the delivery of their own instruction, or model through lesson design and classroom practice those teaching and learning processes that reflect the needs of the learners. As Loughran states (2007), "one difficulty associated with framing professional identity through the lens of the ex-school teacher is that the teacher educator may be viewed as simply being a teacher teaching in teacher preparation rather
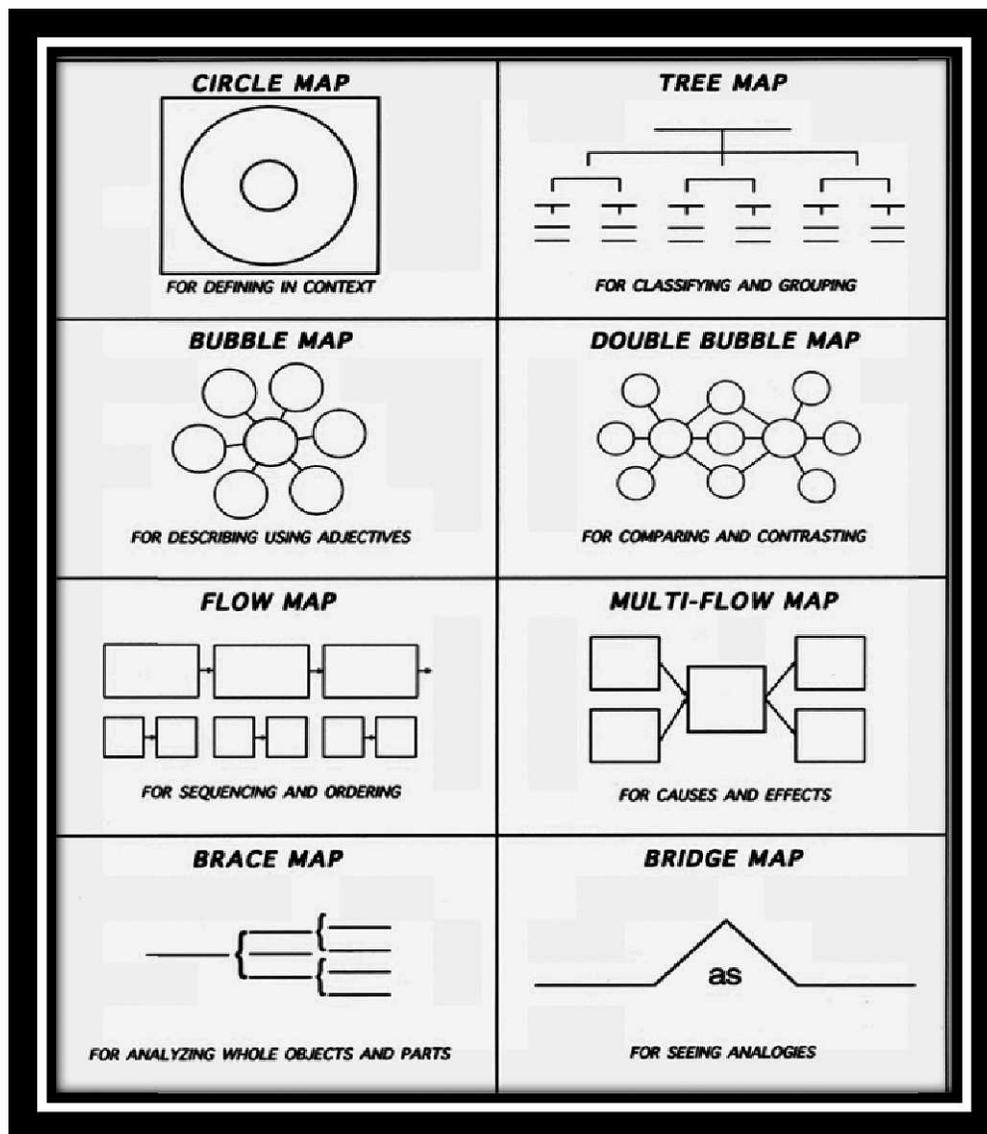
Figure 1. Eight Thinking Maps. Adapted from ''Thinking Maps, Inc''., 2009

than as a teacher educator with an expertise in teaching and learning about teaching" (p. 13). These best-practice instructional strategies should also be modeled and included as an integral part of teaching and learning in College of Education courses. Therefore all stakeholders in the PDS partnership, including the university professor, needed to be willing to learn Thinking Maps and to effectively model them for students.

Over a two-year period, the university professor attended two national Thinking Maps conferences with a team of ten faculty from Moanalua Middle School. This small learning community used these opportunities to hone their skills in Thinking Maps and to gain additional learning experiences to share with the remaining faculty and pre-service candidates in the PDS. Additionally, the professor also attended a four-day intensive Training of Trainers for Thinking Maps with

Table 1. *Qualities of Thinking Maps*

Quality	Description
Consistent	Each of the eight maps is a symbol that is unique and consistent that represents the cognitive skill being implemented.
Flexible	While the cognitive skill and initial primitive form of the map are consistent, there is also flexibility in the ways a map can be changed regarding form, complexity, and configuration.
Developmental	As a result of the consistency and flexibility of the eight maps, learners are able to show their development in thinking as they move from a blank sheet of paper to filling the entire page with the expansion of a Thinking Map. This expansion is a visual demonstration of the developmental thought maturity of each learner.
Integrative	Thinking Maps apply the two key dimensions of integration as they can be used singly and integrated together to accomplish complex thinking. Thinking Maps can be used within and across content areas.
Reflective	As a visual language, Thinking Maps tell us what and how one is thinking. This allows the learner and the teacher to view the map, reflect on the thinking pattern, and even do an informal assessment. Thinking Maps also employ use of the frame of reference around the map, students are now asked to take their thought process one step higher and tell both what they know and how they know it.

2 Moanalua Middle School faculty and the school principal. These PDS members became the first set of Thinking Maps trainers in the state.

Shared knowledge gained from these conferences and training workshops was delivered continuously over a two-year period through team planning periods, professional development days, and faculty meetings. The entire PDS community received training and experience using Thinking Maps. To ensure the use of Thinking Maps in all classrooms at MMS, structures were put in place for sharing and discussing lesson plans that integrated Thinking Maps, student exemplars were shared and discussed, a lesson-study learning community (led by the university professor) was created, and the school principal actively used Thinking Maps in all facets of communication with her staff. Thinking Maps were visible everywhere within the PDS partnership.

The implementation of Thinking Maps began as a joint learning/teaching venture at Moanalua Middle School during the 2006 school year. The school year began with professional development activities led by the university professor and school principal that provided an overview of Thinking Maps, why Thinking Maps are a research-based practice, and how to use the first map, the Circle Map. The faculty was given the task of introducing the Circle Map to and using it with all of their classes, and then bringing three exemplars to a designated professional-development-through-team-planning meeting during the first month of school. Faculty shared and discussed how they were using the Circle Map (Figure 2) in small learning communities and then within the larger learning community at the first faculty meeting of the school year. Each month thereafter, another Thinking Map was introduced and taught to faculty. Faculty implemented each new map in all of their classes during that month, and sharing and discussion of the map would then occur at designated team planning meetings and faculty meetings (Figures 3 & 4). This monthly process continued until the end of the school year. As new students entered Moanalua Middle School and faculty changes occurred the following year, the same protocol was implemented. However, during the second year, faculty training of Thinking Maps went beyond identification of the eight
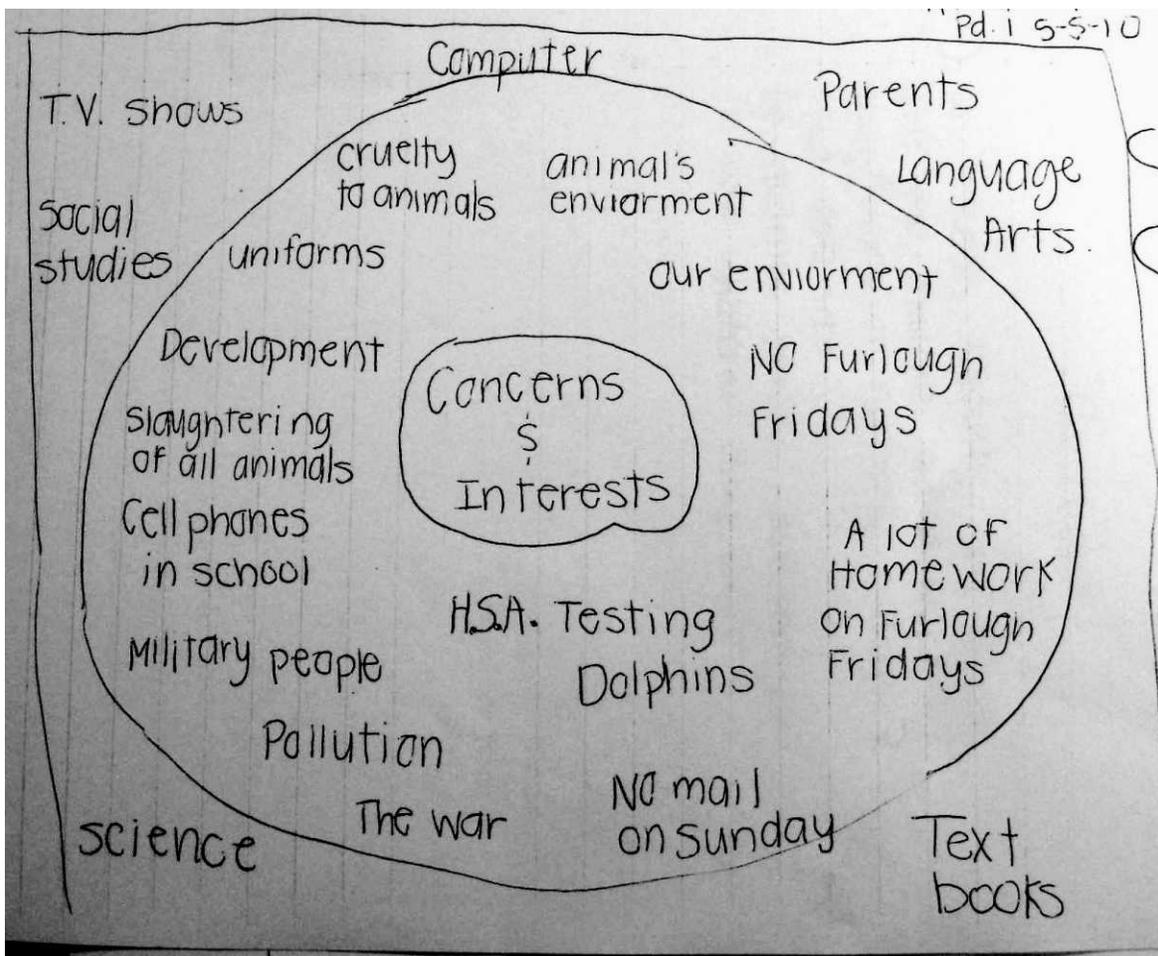
Figure 2. Circle Map. Student Exemplar. Reprinted with permission

maps to finding new, innovative ways to implement all maps consistently in all classes, including art, music, and physical education.

Once the staff, faculty, and MEdT candidates were using Thinking Maps as part of their everyday language for thinking processes, consistent thinking habits became defined, explained, and discussed in every classroom to develop student understanding. Teachers were able to employ Thinking Maps to intentionally assist students with developing the productive habits of mind that enhanced learning outcomes (Marzano & Pickering, 1997). Wiggins (2008) summarizes

ways that teachers can facilitate better habits of mind for their students:

You don't develop a habit by direct instruction or informing students of the value of the habit, and you don't develop a habit by having it merely demanded of you... To talk of better habits is to talk about something becoming "second" nature. It depends upon incentives, reinforcement, modeling. It means that you have to recognize when the old habit is acting, when to try a new habit, and practice in using the new habit and seeing its value. That takes time, repetition, situations that reward the new habit; and it takes wise, savvy, tactful teaching (p. 1).

Figure 3.   Double Bubble Map. Student Exemplar. Reprinted with permission

Research Aims

This study was designed to collect and investigate relevant data on the impact of Thinking Maps on the two goals for our PDS:

1. To develop highly qualified teachers who would positively impact student learning.
2. To employ research-based practices so everyone in the learning community simultaneously becomes teacher and learner.
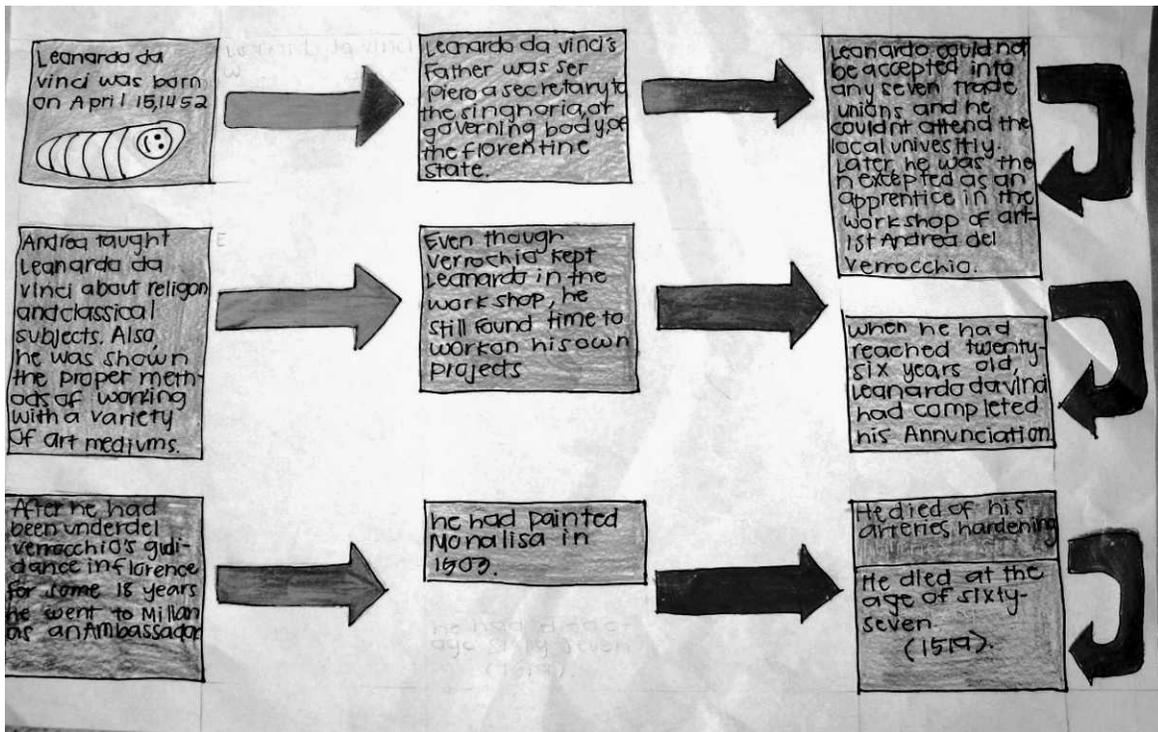
Figure 4.   Flow Map. Student Exemplar. Reprinted with permission

Methodology

Emergent Design, as coined by Cavallo (2000), was employed for this study. The stakeholders used Thinking Maps to determine if the PDS partnership provided a shared commitment to implementing innovative learning strategies. Strategies were used for increased student learning at the same time everyone in the community was actively engaged as life-long learners. The participants, 7th and 8th grade students and faculty, including pre-service teachers, were given the same forced-choice survey in August 2006, June 2007, and October 2008. In January 2009, an open-ended survey was given to all faculty members and 32 randomly selected students (sixteen in seventh grade and sixteen in eighth grade). There were 70 faculty members on staff at Moanalua Middle School in 2006, 2007, and 2008. The forced-choice survey was given to faculty as part of a mandatory professional development day and all 70 surveys were completed and collected.

To ensure that the majority of all students at MMS completed and returned the forced-choice survey, all students were given the survey during their advisory period. This produced a 97% completion rate each time the survey was administered. The forced-choice survey was created by Hyerle (2004) and was reproduced from conference materials collected by the stakeholders in 2006. The principal, site coordinator, and university professor created the open-ended survey.

A grounded theory approach was used to code the data (Strauss & Corbin, 1990) and create a thematic analysis. Grounded theory is a methodology where a theory is constructed from data that have been collected when the initial explanation of phenomena is not known. This small study makes it nearly impossible to create a theory from the data, so the grounded theory design was followed closely to determine emergent themes in response to the questions. To make this a true grounded theory study, the data would need to be collected over a longer period of time with a

much larger population (Glaser & Strauss, 1967). Using forced-choice and open-ended questions worked within the realm of grounded theory because it allowed for the discovery of themes from the PDS stakeholders.

The responses from the surveys were open-coded to determine initial categories using systematic design for grounded theory. Creswell (2005) stated that thematic analysis through grounded theory is a widely used method in educational research. Afterwards, the data was axial-coded to define interrelationships and potential conditions between categories. The final categories were determined using selective coding.

Limitations

In the context of this study on one instructional strategy, the action research is a "focus for inquiry" (Golby, 1989, p. 168), with no intent to generalize the results to a population of teachers. However, this action research can serve as an example of good practice. Stenhouse (1985) states, "vigorous forms of case study inquiry have the potential to provide illuminating and fruitful insights into classroom-based teaching and learning that offer teachers and other researchers a sound basis for making professional decisions and judgments" (p. 12).

The author's (university professor) relationship with Moanalua Middle School could also have served as a limitation. The MEdT courses were taught on-site at Moanalua Middle School; thus, the author had frequent interaction with faculty and staff at the school in terms of visiting classrooms, collaborating in professional development activities, and engaging with faculty in lesson plan design. While the author strongly encouraged participants to respond truthfully, this on-going engagement could have potentially limited the candidness of responses in the survey process. Every attempt was made to safeguard anonymity within a comfortable and non-threatening environment.

Findings

The forced-choice surveys were given to faculty and students to determine their mastery of Thinking Maps and the thought processes associated with each map. The same survey was used each time it was administered (2006, 2007, and 2008). This allowed the author to measure growth over time before, during, and after training Thinking Maps to faculty, and teaching and using Thinking Maps with students at Moanalua Middle School. Through the strengths and weaknesses identified in these surveys, the PDS partners began to identify areas that were effectively taught to the learning community and identify Thinking Maps that needed to be retaught.

The open-ended survey was given out to all 70 faculty members. Twenty-three faculty members responded, most likely because the survey was not completed in a group meeting but depended on the faculty to complete them on their own time and return them to the university professor. Thirty-two students were randomly selected to complete the open-ended survey. All 32 surveys were completed.

Theme 1: Impact on student learning. The first emergent theme was the impact of Thinking Maps on student learning. The forced-choice and open-ended surveys began to provide a glimpse on the role Thinking Maps played in the daily learning communities.

When discussing the benefits of Thinking Maps on student learning, faculty cited different ways in which their students were more confident in their abilities to distinguish and organize relationships between and within topics. Two teachers talked about students using Thinking Maps on their own for pre-writing and reading activities. Four language arts teachers and one social studies teacher specifically commented on their students being able to construct more easily a five-paragraph essay by organizing ideas with Thinking Maps. Some of the faculty observed that sureness and self-confidence were apparent because "students are more energetic probably because of confidence when they help each other," and "When
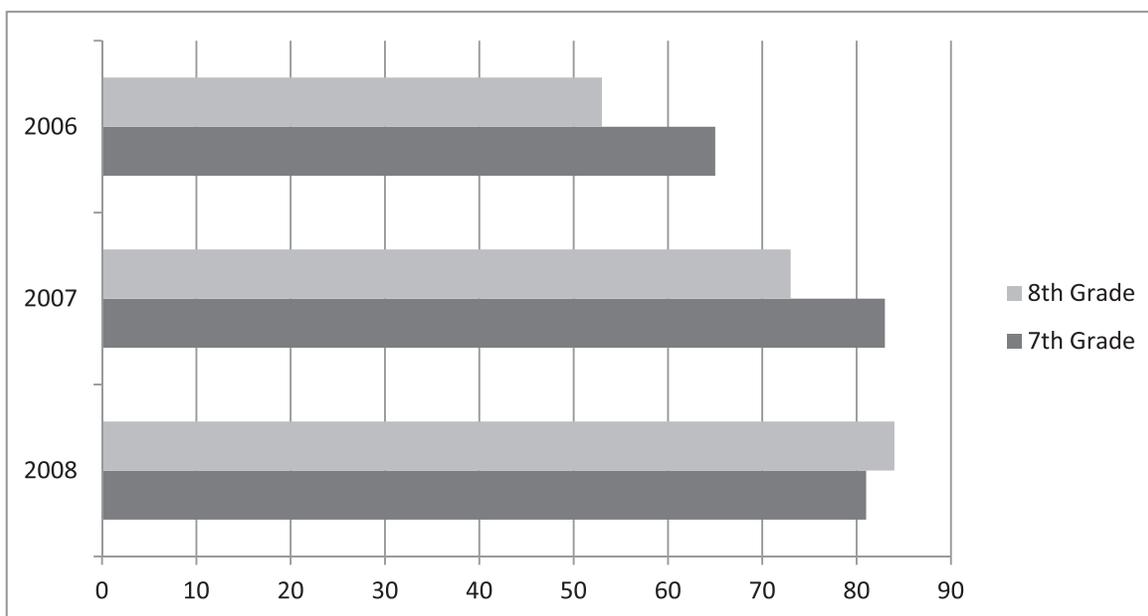
Figure 5.   M Middle School State Assessment Scores for Reading. Retrieved from H Public Schools, 2012

teaching something new using something old it really increases students' chances for success. It feels good to see your own students so confident in their learning." The responses suggest that having a common language for teaching thinking skills builds a bond between all faculty, all classrooms on campus, and all learners. This impact on student learning has also been seen in other schools in the country. Holzman (2005), a principal in California stated, "Thinking Maps are an important strategy for student success. They help all children, whether their primary learning style is kinesthetic, auditory, or verbal. It can be effectively used to support higher level thinking skills as well as low student achievement. It matches the content standards" (p. 3). Faculty at Moanalua Middle School found similar results within their own school. The following comments came from faculty, based on the use of Thinking Maps in their own classrooms:

- The maps are easy for students to use, especially as a reading strategy
- They support differentiated instruction
- State standards are easily met using Thinking Maps in our classrooms

Student responses to the surveys also support the positive impact Thinking Maps have on their own learning. The majority of students reported that they felt empowered in their work because they could own their Thinking Map and their thinking. One student stated, "Thinking Maps help students see their thinking. You lay out facts, opinions, etc. on maps and you are able to compare, contrast, classify, define, describe, etc. them."

Theme 1 can be further supported by looking at the State Assessment Scores (HSA) for reading at Moanalua Middle School (Figure 5). It is important to note that the increased reading scores cannot be solely due to Thinking Maps in the PDS relationship. However, Thinking Maps was one of two (TRIBES) research-based instructional practices initiated school-wide in 2006–2009.

In the early years of No Child Left Behind, gains in reading scores of 3–5% were achieved each year at MMS through May 2005. In the fall of 2005, Thinking Maps were introduced to the PDS learning community. In May 2006, Moanalua Middle School had 58% of students reading at grade-level proficiency. In 2007, a significant gain of 20% was recorded on the HSA for reading and 76% of Moanalua Middle

School students were grade-level proficient readers. With sustained support and strengthening of practice of Thinking Maps, 2008 HSA reading results showed that grade-level reading proficiency had jumped to 86% at Moanalua Middle School. It should also be noted that various middle school content areas (language arts, social studies, science, and math) also had new state-wide standards being implemented in 2007 and 2008. Moanalua Middle School is not the only school that has integrated Thinking Maps into their curriculum to improve student achievement scores. In the first year of implementation of Thinking Maps at Elder Middle School in Georgia, students surpassed the math achievement benchmarks set forth by the state for the first time (SEDL Letter, 2010).

Theme 2: Everyone in the learning community simultaneously becomes a teacher and a learner.

> I think I have worked with a lot of school-wide initiatives over the years and Thinking Maps is the only school-wide initiative that I feel/believe has 80%+ faculty understanding and active use. The accountability and experience has really boosted use this year.

> —7th grade teacher at
> Moanalua Middle School

Stakeholders in the PDS perceived that shared vision, continuous embedded professional development of teachers and students actively learning together, and collaborative leadership contributed to the successful implementation of Thinking Maps. Faculty described their mastery of Thinking Maps skills through school-wide orchestration of trainings, collaborative discussions, classroom walk-throughs, and sharing exemplars. In 2005, Holzman shared what was happening in her school with Thinking Maps: "We have found that they have helped us develop a common language. They lead to reflective conversations and collaborative efforts among all teachers—including new teachers. Thinking Maps are being used everywhere. At

my staff meetings, I don't have an agenda—it's a map" (p. 6). Brevard County Public Schools in Florida (FDLRS, n.d.) has also seen the benefits of Thinking Maps to the extent that they have created an on-line learning community to support simultaneous learning and teaching of this instructional strategy.

Sixty-seven faculty out of 70 were able to effectively define all eight Thinking Maps by the end of the 2008 school year. By the winter of 2009, these same teachers (96% of the faculty) could consistently define the eight Thinking Maps and model six out of eight Thinking Maps in their classrooms. The Bridge and Brace maps were identified by 64% of the faculty as being difficult to implement in their classes. One teacher stated, "I find the Bridge Map to be the most difficult to use in class because I am not good with analogies and therefore lack the confidence to effectively teach it to my kids." Using this data, the principal and professor were able to focus professional development sessions around these two maps. Since Thinking Maps are prevalent in all facets of the PDS, one MEdT candidate (included in the faculty survey results) stated, "More and more teachers are using Thinking Maps correctly. More and more teachers come to realize the value of it as opposed to "another strategy" or "more work."

By the end of the 2008 school year, the results showed that 97% of the student body (those that were in attendance for advisory on the day the surveys were given) could identify all eight Thinking Maps. The student forced-choice survey also asked a separate question related to the thought process associated with each Thinking Map. Again, students indicated (97%) that they could associate the thinking process with the map on six of the eight Thinking Maps. One student even noted, "I use the Flow Map at home to show my mom why I should get my allowance." The two maps with which students indicated competency but lower than mastery percentages were the Bridge Map (showing analogies) and the Brace Map (identifying parts-to-whole relationships).

Conclusions

Stakeholders in the PDS learning community placed a great deal of emphasis on the benefits of Thinking Maps. The theme associated with all stakeholders being both teachers and learners at the same time is also interconnected with the theme related to impact on student learning. The literature supports the notion that in order to effectively teach an instructional strategy, the teacher must also have mastered the skill. The two goals for this PDS specifically set out to address these two themes. According to faculty and student perceptions, Thinking Maps were a significant vehicle for the success of this PDS.

The literature supports the importance of building a community of learners within the PDS partnership. It is imperative to have buy-in from all of the stakeholders, not just through words, but also through actions. Holonomy has been described as a community where individuals find value not just within themselves but also within their larger team. The team, or learning community, works towards a common goal(s) and is able to do so in a learning community that focuses on creating quality teachers and improving student learning. It was of no surprise to this holonomous PDS community that the Bridge Map and Brace Map provided the most difficulty for faculty and students. But because of the holonomous relationship, the deficiencies using these two maps would become the focus of future sustained professional development.

This study revealed that through Thinking Maps, teachers collaboratively used common tools and a common language, and students gained a specific language to describe eight different thought processes. Teachers and students both understood the taxonomy of thinking and the value of the Thinking Maps as tools to help them move to higher levels of thinking, analysis, and problem solving. SUP

References

Barth, R. (1990). *Improving schools from within: Teachers, parents, and principals can make a difference*. San Francisco: Jossey-Bass Publishers.

Brevard Public Schools. (n. d.). Retrieved April 2, 2012 from http://fdlrs.brevard.k12.fl.us/ThinkingMaps/default.html.

Cavallo, D. (2000). Emergent design and learning environments: Building on indigenous knowledge. *IBM systems journal, 39*, 768–781.

Costa, A. L., Garmston, R. J. (2002). *Cognitive coaching: A foundation for renaissance schools*. Massachusetts: Christopher-Gordon Publishers, Inc.

Darling-Hammond, L. (2000). How teacher education matters. *Journal of Teacher Education, 51*, 166–173.

Freese, A. R. (April, 2004). Evaluation as a way of knowing: assessing the impact of a PDS. Paper presented at the annual meeting of the American Educational Association Research Association, San Diego, CA.

Golby, M. (1989). Teachers and their research. In W. Carr (Ed.), *Quality in teaching: Arguments for a reflective profession* (pp. 163–173).

Hawaii Public Schools (2012). State reading assessment scores. Retrieved April 2, 2012 from http://doe.k12.hi.us/.

Holzman, Stefanie (2005). Aiming high. Sonoma county office of education newsletter. Retrieved April 2, 2012 from http://www.scoe.org/files/AH_maps.pdf.

Hyerle, D. (2004). *Student successes with thinking maps: school based research, results, and models for achievement using visual tools*. California: Corwin Press.

Hyerle, D. (2005). Aiming high. Sonoma county office of education newsletter. Retrieved April 2, 2012 from http://www.scoe.org/files/AH_maps.pdf

Kessler, C. & Wong, C. (2008). Growing our own: A learning community partnership between a university and public middle school, In Samaras, P., Beck, C., Freese, A., & Kosnik, C. (Eds.), *Learning communities in practice*. New York: Springer Press.

Loughran, J. (2007). Enacting a pedagogy of teacher education. In T. Russell & J. Loughran (Eds.), *Enacting a pedagogy of teacher education: Values, relationships, and practice*. New York: Routledge.

Marzano, R., Pickering, D., & Pollock, J. (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement.* Alexandria, Va.: ASCD.

Marzano, R. J., & Pickering, D. J. (1997). *Dimensions of learning.* Alexandria, VA: Association for Supervision and Curriculum Development.

National Association for Professional Development Schools (NAPDS). (2008). *What it means to be a professional development school.* Retrieved August 21, 2010 from http://napds.org/9%20 Essentials/statement.pdf

National Council for Accreditation of Teacher Education (2006). *What makes a teacher effective?* Retrieved April 17, 2007 from (pamphlet).

SEDL Letter (2010). A plan for success: Using thinking maps to improve student learning in Georgia. Retrieved April 2, 2012 from http:// www.thinkingmaps.com/ckeFiles/ThinkingMaps %20SEDLLetter_v22n01%20final.pdf.

Strauss, A. & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques.* London: Sage.

Stenhouse, L. (1985). The case study tradition and how case studies apply to practice. In J. Riddick & D. Hopkins (Eds.), *Research as a basis for teaching: Readings from the work of Lawrence Stenhouse.* London: Heinemann.

Thinking Maps, Inc. (2012). Thinking maps: visual thinking tools that get results. Retrieved January 2012, from http://www.thinkingmaps.com/.

Toppo, G. (2007). Usefulness of education research questioned. Retrieved April 2007, from http:// www.usatoday.com/news/education/ 2007-04-10-education-science_n.htm

Wiggins, G. (2008). A conversation with Grant Wiggins: Habits of mind. Retrieved May 7, 2009, from http://www.authenticeducation. org/bigideas/article.lasso?artId=48.

❖ ❖ ❖

Cristy Kessler is an associate professor who serves as coordinator of the PDS between the Masters of Education in Teaching Program (MEdT) at the University of Hawaii and Moanalua Middle School on the Island of Oahu. She also is a National Board Certified teacher and assists in-service teachers in her PDS to become National Board Certified. Dr. Kessler has been on sick leave for the past year and a half while waiting for a life saving bone marrow/stem cell transplant.

Deborah Zuercher is a colleague of Dr. Kessler at the University of Hawaii. She helped to organize the information for this article until Dr. Kessler was on the road to recovery. Dr. Zuercher specializes in Middle Level Education.

Caroline S. Wong served as principal of Moanalua Middle School for over fifteen years prior to retiring in 2008. She secured the Thinking Maps curriculum and provided all levels training and staff development. In 2005, Mrs. Wong was named Middle School Principal of the Year.