Teaching The Pedagogical Content Knowledge Of Astronomy

Syftet med avhandlingen är att undersöka hur och under vilka villkor som svensklärares kunskap om skrivundervisning växer fram i och efter lärarutbildningen. I en delstudie analyseras hur skrivande, skrivutveckling och skrivundervisning framställs och förmedlas som kunskapsområden i kursplaner som beskriver ämnesteoretiska och ämnesdidaktiska kurser i

ämneslärarutbildningen i svenska. Resultatet visar att det i detta hänseende finns ett påtagligt tomrum som dels kan relateras till den låga andelen mål som uttryckligen handlar om skrivande, skrivutveckling och skrivundervisning i skolan, dels kan relateras till ord och uttryck som har svag referens till skrivundervisning som ett skrivutvecklande arbete. Den andra delstudien handlar om vad blivande och verksamma gymnasielärare i svenska lägger tyngdpunkt på när de i kvalitativa intervjuer talar om text, skrivande och skrivundervisning. Resultatet visar ett mönster som går från fokus på konkreta textdetaljer på lokal textnivå till ett mer

övergripande förhållningssätt där samtliga textnivåer tycks samspela i en mer balanserad helhet. I samma material analyseras hur kunskap som kan relateras till skrivundervisning manifesteras när intervjupersonerna talade om skrivundervisning. I de blivande lärarnas utsagor manifesteras främst ämneskunskap, medan de verksamma lärarna främst manifesterar skrivdidaktisk kunskap. Lärarnas ämneskunskap är också mer komplex än studenternas. Den tredje delstudien handlar om hur nyblivna svensklärares skrivdidaktiska kunskap förändras under det första året i yrket och vilka faktorer som ligger bakom en sådan

förändring. Genom kvalitativa intervjuer vid tre tillfällen (september, februari och juni) undersöks hur lärarna tycks transformera sina ämneskunskaper till undervisningsstrategier i skrivundervisningen. Resultatet visar att lärarnas strategier för att undervisa i skrivande förändras under läsåret. Förändringen tycks gå från en teoretisk och överförande undervisning till en mer praktisk och upptäckande undervisning. Detta pekar på en förändrad skrivdidaktisk kunskap. Det verkar främst vara arbetet tillsammans med eleverna som leder till denna förändring. En annan viktig faktor tycks vara återkommande moment (cykler)

som gör det möjligt för lärarna att omvandla sin förståelse av skrivutvecklande arbete tillsammans med eleverna. Sammantaget pekar avhandlingens resultat på att svensklärares skrivdidaktiska kunskap främst utvecklas i yrket. The teaching of writing is a complex activity. The aim of this thesis is to investigate when and how the knowledge needed for the teaching of writing is developed in teacher education and during the first years of teaching. One sub-study focuses writing, writing development and the teaching of writing in teacher education syllabi. The result shows that the objectives with focus on writing and writing development in school are

relatively few and that the main emphasis is on the teachers' work when the students have already finished writing. Furthermore, the expressions used in the syllabi vary in specificity, which might lead to difficulties detecting the teaching of writing as a field of knowledge in the teacher education programme. In the second sub-study, one analysis focuses on the way in which prospective and novice teachers of Swedish talked about text, writing, and the teaching of writing. The result shows a development that starts with a focus on details at a local text level and expands into a more comprehensive view with a focus on global text levels. The second

analysis concerns subject matter knowledge and pedagogical content knowledge (PCK) for teaching writing. The result shows that the knowledge manifested by the prospective teachers mainly consists of subject matter knowledge, whereas the knowledge manifested by the teachers mainly consists of PCK for teaching writing. In the third sub-study, nine novice Swedish teachers were interviewed in September, February and June during their first year in the profession. This study focuses on the transformation of the teachers' subject matter knowledge into teaching strategies. The result shows that the teachers' use of teaching

strategies changed throughout the year. There is a shift from theory and transmission to practice and discovery. What mainly causes this shift seems to be the teachers' work together with their students and the possibility to teach the same content or field of knowledge repeatedly. The overall analysis thus shows that the PCK for teaching writing is mainly developed in the teaching profession; in other words, after the exam from the teacher education programme.

This dissertation, "The Development of Pedagogical Content Knowledge in Novice Secondary School Teachers of English in the People's Republic of China" by □□□, Xiaoyan, Judy,

Zhu, was obtained from The University of Hong Kong (Pokfulam, Hong Kong) and is being sold pursuant to Creative Commons: Attribution 3.0 Hong Kong License. The content of this dissertation has not been altered in any way. We have altered the formatting in order to facilitate the ease of printing and reading of the dissertation. All rights not granted by the above license are retained by the author. Abstract: Abstract of thesis entitled The Development of Pedagogical Content Knowledge in Novice Secondary School Teachers of English in the People's Republic of China submitted by ZHU, Xiaoyan Judy (□□□) for the Degree of Doctor of Philosophy at the University of Hong Kong in

July 2003 This study investigates pedagogical content knowledge (PCK) development in four novice EFL teachers during their second or third years of teaching in Guangzhou, PRC. Although research on PCK began in the late 1980s, most studies have centred on either expert or student teachers/first-year teachers, and have captured snapshots of PCK at a certain point in their subjects' teaching careers. Few have researched PCK growth longitudinally. The present study explores how teachers' PCK evolves during their early years of teaching, and identifies a trigger for PCK development. The research is content-specific (teaching of EFL), context- specific

(Guangzhou), and subject-specific (novices beyond their first year of teaching). It uses an analytical framework adapted from Shulman (1986, 1987); Grossman (1990, 1995) and Turner-Bisset (1999, 2001), which focuses on six components of PCK: conceptions of teaching purposes, knowledge of curriculum, subject matter knowledge, knowledge of students, knowledge of pedagogy, and knowledge of self. This qualitative research employs multiple case studies for in-depth study. The four informants were deliberately selected. They had completed their pre-service and induction teacher education programmes and were members of the first generation of Chinese

secondary teachers of English required to implement the newly-promoted communicative language teaching (CLT) under the new English curriculum launched in 1992. The data collected from the four teachers between July 1999 and June 2002 included 14 lesson plans, 17 videotaped lessons, 22 written reflections and 27 semi-structured interviews. The results indicate that the four novices experienced a gradual transition from a firmly teacher-oriented to a slightly more learner-oriented perspective. This transition was marked in the teachers concerned by a steady shift from a technique-based to a student-based understanding of teaching; from unquestioning

implementation to initial reflection, and from a rigid to a slightly more flexible pedagogy. Their change was characterized by an ongoing, uneven and unstable progression in their learning-to-teach experiences. The significance of the study is that different forms of PCK emerge over time. At the outset, the six elements are in a rather rudimentary and separate state of development. Context-free knowledge of pedagogy, superficial knowledge of students and limited curricular knowledge are most in evidence, but relate to each other at a fairly superficial level. This relationship deepens over time. Analysis of the data suggests that knowledge of students plays

an important role in triggering PCK development and integration. This study argues that the teachers' PCK develops out of the contextualised conceptualizations of their understanding of students and teaching, professional learning and reflective practice, and that there is a dialectical relationship between their developing PCK and the context within which they work. In the PRC context, Master's Thesis from the year 2011 in the subject Computer Science - Didactics, University of Twente (Behavioural Science), course: ICT in science and mathematics - Educational Science and Technology, language: English, abstract: This study investigated the ways

through which pre-service science and mathematics teachers at Dar es Salaam University College of Education (DUCE) can acquire competencies for integrating technology pedagogy and content in teaching. Specifically the study investigated the preservice teachers' ICT integration competencies; practices that can be effective in enhancing pre-service science and mathematics teachers' competency in integrating technology, pedagogy and content; as well as the impact of those practices in the development of preservice teachers' technological pedagogical content knowledge. An action research approach was employed in the study,

employing the pre and post-intervention assessment of preservice teachers' knowledge on technology, pedagogy and content. Planed interventions were carried out during the study, to enable preservice teachers to identify areas of weaknesses in their technology integration competencies, and propose alternative approaches for addressing the identified weaknesses. Student questionnaire, instructor interview and observation checklist were used to collect date before, during and after intervention. Researcher's log book, digital camera and audio recorder were used in recording events and activities taking place during the study. Findings

revealed that when preservice teachers engage in hands on activities such as microteaching, lesson design and the opportunity to share their ideas with peers, they easily developed their technological pedagogical content knowledge. An analysis of knowledge change after the intervention, showed a significant difference between pre-intervention and post intervention preservice teachers' knowledge of TPACK. It is therefore concluded that, the adoption of hands on activities that uses technology and involve teachers in planning of what to teach, how to teach and with what technology to teach, and provision of an opportunity to share this plan with colleagues,

can make a significant change in the development of TPACK among preservice teachers. Effective teaching with technology requires a developed, nuanced understanding of the complex interplays between three key kinds of knowledge: content knowledge, pedagogical knowledge, and technological knowledge; and how they play out in specific contexts (Mishra & Koehler, 2006). Mishra and Koehler's (2006) model for describing this complexity of knowledge is called technological pedagogical and content knowledge (TPACK). Much of the research about TPACK attends to pre-service and practicing teachers' beliefs and attitudes about technology and about self-

efficacy beliefs regarding integrating technology in practice. Additional research uses rubrics to assess TPACK but are limited in that the data sources are oftentimes only a lesson plan. The purpose of this study was to characterize teachers' TPACK more comprehensively by attending to the planning of, the implementation of, and reflections about lessons that incorporate technology. The data for the study came from a graduate course for middle school science and mathematics teachers about using technology in instruction. The course was taught four times over four years and included an assignment called the Technology Lesson

Cycle. The Technology Lesson Cycle, a representation of how teachers operationalize their TPACK in practice, consisted of a written lesson plan, video of implementation of the lesson, and a written reflection about the lesson. The first phase of this study was the development of a rubric to characterize TPACK. Interrater reliability of the rubric was examined using Intraclass Correlation, and the internal consistency of the scores was tested using Cronback's Alpha. Once reliability and validity of the rubric was established, fifteen Technology Lesson Cycles were assessed. Findings from the study illustrate that the in-service mathematics teachers' pedagogical knowledge (PK) and

the knowledge components that contain PK are significantly weaker than other components. Among all seven TPACK components, the technological pedagogical knowledge (TPK) was the weakest knowledge component. This work brought forward a deeper understanding of how TPACK translates to practice. Recommendations were provided for teacher education programs and for future studies.

Examining Pedagogical Content Knowledge

Learning to Teach Writing

The Development of Pedagogical Content Knowledge in Novice Secondary School Teachers of English in the People's Republic of China

A Study of the Pedagogical

Content Knowledge of Science Teachers

The Impact of Content and Pedagogy Courses on Science Teachers' Pedagogical Content Knowledge

Repositioning Pedagogical Content Knowledge in Teachers' Knowledge for Teaching Science

The purpose of this dissertation project is to explore preservice science teachers' development of pedagogical content knowledge (PCK) for targeted aspects of nature of science (NOS) and nature of scientific inquiry (NOSI). Through multiple data sources, it is examined how preservice

science teachers' understanding of NOS and NOSI have changed over the program, and manifests itself in their classroom practice. This is an exploratory multiple case study of participants' experiences and developments during a teacher development program. Data is collected in the form of open-ended surveys, interviews, observations, lesson plans, video materials, and teaching documents. After all data is collected, two participants, Charlie and

Rose, are purposefully selected among those who participated in this program in order to show a successful NOS and NOSI teaching practice. All data is analyzed in three stages. The first stage includes the analysis of the questionnaires, interviews, students' works, and classroom observations before the two-weeks teaching practicum in order to describe of the development of their views and schema of their PCK for NOS and NOSI. The second stage includes the

analysis of two weeks teaching practicum. The data from preservice teachers' teaching videos, teaching reflections, and observations are analyzed in order to understand what and how they teach regarding NOS and NOSI. In the last stage, two analyses are compared for consistency/inconsistency to answer of how their PKC is represented in their teaching practice, and the factors mediate their teaching is compiled. Data analysis indicates Charlie begin the program with mixed views, while, Rose

has better views of NOS and NOSI at the beginning of the program. During the program, both two preservice teachers improve their understandings of almost all of the NOS and NOSI aspects. Data analysis about development of Rose and Charlie's PCK for NOS/NOSI indicates at the beginning of the program, Rose has better ideas of teaching NOS and NOSI than Charlie. She has a clear plan and organization to teach specific NOS and NOSI aspects. She is aware of different teaching

strategies and assessments techniques, and how to use those while teaching NOS and NOSI. On the other hand, Charlie has very general ideas and views of teaching science. At the end of the program, there is a huge improvement on both Rose and Charlie's understanding of PCK. For integrating their knowledge, and factors mediate their abilities and teaching experience, Rose and Charlie successfully integrate the components of their PCK to create learning opportunities for their

students. They rely upon their knowledge of subject matter, representations, instructional strategies, assessment, and curriculum to create opportunities, which engage students in making and testing predictions as well as supporting claims and conclusions with evidence. Also, some additional factors such as, teacher self-efficacy, lesson planning, or general pedagogical knowledge have quite a few impacts on their teaching practicum. The Pedagogical Content Knowledge in an

Educational Context (PCK-EC) model is proposed as a framework to support teachers, coaches and researchers in the examination of teacher knowledge within a specific context and with a particular focus. This framework combines the theoretical and practical aspects represented by five dimensions of teachers' attitudes and teachers' knowledge (technology, learners' cognition, subject matter, pedagogy) within an educational context that includes curricular,

technological, social, cultural, and teaching - learning contexts.Two case studies were used to examine the utility of the proposed PCK-EC model. Data collected included: semi-structured initial and final interviews; teacher's journals of reflection (completed after teaching each lesson); direct observations during lessons; observations from video recordings of lessons; transcripts from initial and final interviews; and other collected documents in

regards to the educational context. The interpretive repertoires method allowed us to identify and characterize groups of themes in each dimension of teachers' attitudes and knowledge, and supported inter-relationships between themes. The PCK-EC was useful to support a deep description of a collection of themes by using different sources of data. Analysis of each one of these collections of themes allowed us to understand teachers' PCK-EC and provided insights about how different

technological tools might affect teachers' attitudes and their knowledge. The dimensions of teachers' attitudes and knowledge are not isolated, but rather they are inter-related during teaching practice. It is possible to recognize inter-relationships (outgoing and incoming) between themes (within and across dimensions). It is suggested that the frequency of the outgoing and incoming inter-relationships found between themes might give us an average weight for

each of the dimensions of the PCK-EC and this could represent teachers' attitudes and knowledge used during teaching practice.The collection of themes identified might be useful as a tool to support teachers as they explore their attitudes and their knowledge needed for teaching a specific topic with the use of technological tools, and may provide coaches with an effective mechanism to support the identification of an individuals' PCK and development needs. Educational technologies

are vastly becoming a common-place entity in classrooms as they provide more options and support for teachers and students. However, many teachers are finding these technologies difficult to use as they were never fully trained on how to utilize it or have received little instruction on how to effectively apply it in the classroom. Technological Pedagogical Content Knowledge (TPACK) Framework for K-12 Teacher Preparation: Emerging Research and Opportunities features contemporary

insights into a multi-year research effort that concluded with the design and development of an online TPACK learning trajectory. Highlighting how this development impacts the design of professional development coursework for educators, this publication is a critical work for in-service teachers, researchers, and online course developers.
There has been a growing interest in the notion of a scholarship of teaching. Such scholarship is displayed through a

teacher's grasp of, and response to, the relationships between knowledge of content, teaching and learning in ways that attest to practice as being complex and interwoven. Yet attempting to capture teachers' professional knowledge is difficult because the critical links between practice and knowledge, for many teachers, is tacit. Pedagogical Content Knowledge (PCK) offers one way of capturing, articulating and portraying an aspect of

the scholarship of teaching and, in this case, the scholarship of science teaching. The research underpinning the approach developed by the authors offers access to the development of the professional knowledge of science teaching in a form that offers new ways of sharing and disseminating this knowledge. Through this Resource Folio approach (comprising CoRe and PaP-eRs) a recognition of the value of the specialist knowledge and skills of science teaching is not only highlighted,

but also enhanced. The CoRe and PaP-eRs methodology offers a new way of capturing and portraying science teachers' pedagogical content knowledge so that it might be better understood and valued within the profession. [Publisher, ed].

New Directions in Technological Pedagogical Content Knowledge Research

Preservice Teachers' Perceptions of how They Learn to Use Educational Technology in Their Teaching

Elements of Pedagogical

Content Knowledge Displayed by Mathematics Teachers in the Teaching of Trigonometry
The Impact of Physics Teachers' Pedagogical Content Knowledge on Teacher Actions and Student Outcomes
A Successful Case Study
Handbook of Technological Pedagogical Content Knowledge (TPACK) for Educators

Pedagogical Content Knowledge (PCK) has been adapted, adopted, and taken up in a diversity of ways in science education since the concept was introduced in the

mid-1980s. Now that it is so well embedded within the language of teaching and learning, research and knowledge about the construct needs to be more useable and applicable to the work of science teachers, especially so in these times when standards and other measures are being used to define their knowledge, skills, and abilities. Re-examining Pedagogical Content Knowledge in Science Education is organized around three themes: Re-examining PCK: Issues, ideas and development; Research developments and trajectories; Emerging themes in PCK

research. Featuring the most up-to-date work from leading PCK scholars in science education across the globe, this volume maps where PCK has been, where it is going, and how it now informs and enhances knowledge of science teachers' professional knowledge. It illustrates how the PCK research agenda has developed and can make a difference to teachers' practice and students' learning of science.

Abstract: "In an era of educational reform, investigating teachers' pedagogical content knowledge has implications for

many involved in education, from policy makers and curriculum designers to those in teacher education. This thesis proposed a model, designed by the researcher, used to examine Shulman's (1986) theory of pedagogical content knowledge. In particular, it addressed primary teachers' pedagogical content knowledge required for teaching measurement. By examining teachers' mathematics pedagogical content knowledge a greater understanding of teachers' professional knowledge was gained enabling improvement of teacher quality, by being

able to identify more clearly individual teacher's needs for professional development. This study addressed four specific research questions. How evident is the teacher's depth of mathematical knowledge of measurement within their teaching? How do teachers show that they understand and address the needs of students when teaching? How to teachers demonstrate their general pedagogical knowledge when teaching? How is a teacher's knowledge and practice impacted by other factors when teaching and what are these major factors? A qualitative research

model was used in which four teachers of Years Three and Four participated, providing four individual case studies. Each teacher was interviewed at the commencement of the study, was observed and recorded throughout their teaching of a sequence of measurement lessons, interviewed prior to and following each lesson, and finally responded to a reflective questionnaire two weeks after the sequence of lessons had concluded. Due to the extensive nature of the data, a series of vignettes was written, based upon MATHEMATICAL

PEDAGOGICAL CONTENT KNOWLEDGE viii identified teaching episodes, significant to addressing the research questions. These vignettes contributed to the cross case analysis (Yin, 2010), along with the other data. The study found that the teachers' knowledge varied considerably in each of the areas of knowledge of teaching, knowledge of students and knowledge of mathematics. Consequently, the teachers were rated differently in relation to their pedagogical content knowledge, ranging from very weak to strong. These differences were

examined in terms of the model, providing evidence that the model effectively explained variations in teachers' pedagogical content knowledge. Factors such as self-efficacy, teacher beliefs and the culture of the school were also shown to influence each teacher's pedagogical content knowledge. The model was shown to be dynamic and it clearly identified how and why pedagogical content knowledge varied from one teacher to another. This study has shown that the model used to represent pedagogical content knowledge demonstrated theoretical,

methodological and diagnostic value. This study concludes with a discussion of implications for policy and practice at system level and for teacher education courses for preservice teachers. The findings of this study provide further understanding of teacher pedagogical content knowledge, which is an essential step towards improving teacher quality and teaching practice. The evidence suggests that this model could be used for further research into pedagogical content knowledge beyond the teaching of measurement."

Pedagogical Content Knowledge (PCK) is the blending of content knowledge and pedagogical knowledge for the purpose of teaching in ways that are comprehensible for learners. Although PCK was initially termed by Shulman in 1986, it has never been operationally defined. This study was based on two primary assumptions: (a) Pedagogical Content Knowledge can be predicted by a set of operational variables, and (b) the conceptualization that PCK develops on a continuum from one end to another, from immature to mature forms of

PCK. The purpose of the current investigation was to: (a) test a proposed operational definition of PCK, and (b) to examine how the PCK of experienced teachers differ in the teaching of their stronger and weaker units of instruction. The study was a descriptive investigation based on the behavior analytic theoretical framework. The investigation was organized into three phases. Phases 1 and 2 included a focus group and individual interviews to (a) gain initial understanding on the teachers' learning history relative to PCK; (b) identify possible contingencies the

teachers' behavior is operating under, that cannot be found by observing the immediate teaching context; and (c) discover variables related to PCK that could be observed during teaching. Phase 3 employed direct observation of two elementary physical education teachers delivering two instructional units that they identified as their stronger and weaker instructional units. The following variables were measured: types and sequence of tasks, instructional forms used, recipient of tasks, type and number of cues used, antecedents for task

modification, type of adaptations, appropriateness of individual adaptations and appropriateness of tasks delivered to the entire class. The results demonstrated differences between the stronger and weaker unit of instruction for one of the teachers. The differences consistently illustrated more depth of CK and more mature PCK displayed in the strong unit of instruction. For the other teacher, the difference between the stronger and weaker units of instruction was variable. Some variables (e.g., types of tasks, instructional forms, and

appropriateness of modified tasks) supported richer CK and more mature PCK in the strong unit of instruction; other variables (e.g., cues used, and antecedents for modifying tasks) indicated richer CK and more mature PCK in the weaker unit. The overall CK and PCK levels of the second teacher were similar in both units. This study contributed to the literature in three ways. Conceptually, this study examined and validated an operational and functional definition for PCK. It also validated the development of PCK on a continuum from an

immature to more mature forms. Methodologically, this study investigated PCK utilizing a behavioral methodology, which was substantially different than previous research that has relied primarily on qualitative descriptions to determine PCK. In contrast, this study used operational variables that were directly observable and measurable. Finally, acquisition of proficient CK was found to be vital for the acquisition of PCK, and can and should be a primary focus of Physical Education Teacher Education Programs (PETE). Other practical

recommendations were made for PETE for improving the teaching and acquisition of PCK.

Ministry of Education, Ghana developed an Education Strategic Plan (ESP) that will provide a strategic framework to guide the development of the education with the aim of improving quality of teaching and learning in order to enhance student achievement. However, during a survey it was identified that students at the Junior High Schools progressed from one stage to another with misconceptions in some topics in Mathematics which was attributed to

teachers' low Pedagogical Content Knowledge (PCK). It became necessary to explore teachers' PCK since it could continue to affect students' achievement in Mathematics. Forty teachers were purposively sampled for the study. Students' common misconceptions in addition and division of fractions were used to construct four in-class problems on and then administered to teachers to explain students' reasoning. Responses from teachers were analyzed with a PCK framework an adapted from previous researchers. Pre-Service Teachers'

Pedagogical Content Knowledge
How Competent Mathematics Teachers Develop Pedagogical Content Knowledge in Statistics Teaching Relationships to Learning Ecologies and Social Learning Networks
Pedagogical Content Knowledge in an Educational Context (PCK-EC)
Developing Pedagogical Content Knowledge for Teaching Writing During the Teacher Education Programme and in the Profession
Teachers' Pedagogical Content Knowledge in Mathematics
Effective teachers have good

pedagogical content knowledge (PCK). Pedagogical content knowledge is the intersection of discipline specific content knowledge and pedagogical knowledge. How effectively are pre-service teachers helped to develop good PCK? In this project we asked our pre-service teachers how they would respond to a particular student misconception before and after teaching three topics, to determine if there had been any growth in their PCK. Although the pre-service teachers had deepened their knowledge on teaching specific mathematics content, few changed their answer to the question or showed a deeper understanding of what the student had understood.

This then has implications for our teaching--we need to make our thinking explicit so that pre-service teachers can see the complexity of these issues.

Technological pedagogical content knowledge (TPCK) reflects a new direction in understanding the complex interactions among content, pedagogy, learners and technology that can result in successful integration of multiple technologies in teaching and learning. The purpose of this edited volume is to introduce TPCK as a conceptual framework for grounding research in the area of teachers' cognitive understanding of the interactions of technology with content, pedagogy and learner

conceptions. Accordingly, the contributions will constitute systematic research efforts that use TPCK to develop lines of educational technology research exemplifying current theoretical conceptions of TPCK and methodological and pedagogical approaches of how to develop and assess TPCK.

Schwartz Powerful Ideas in Elementary Mathematics: Pedagogical Content Knowledge for Teachers, 1/e ISBN: 0205493750 "This book would be a great tool for helping [today's future elementary teachers] acquire a 'gut level' understanding of mathematics concepts." - Hester Lewellen, Baldwin-Wallace College, OH "The writing in this text is very

clear and would easily be understood by the intended audience. The real-world examples put the various math concepts into a context that is easily understood. The vignettes at the beginning of each chapter are interesting and they get the reader to begin thinking about the math concepts that will follow. Each of the chapters seem to build on one another and the author often refers back to activities and concepts from previous chapters which is meaningful to the reader because it lets the reader know that the information they are learning builds their conceptual understanding of other mathematical concepts. " - Melany L. Rish, University of South Carolina, Aiken

Organized around five key concepts or "powerful ideas" in mathematics, this text presents elementary mathematics content in a concise and nonthreatening manner for teachers. Designed to sharpen teachers' mathematics pedagogical content knowledge, the friendly writing style and vignettes relate math concepts to "real life" situations so that they may better present the content to their students. The five "powerful ideas" (composition, decomposition, relationships, representation, and context) provide an organizing framework and highlight the interconnections between mathematics topics. In addition, the text thoroughly integrates discussion

of the five NCTM process strands. Features: Icons highlighting the NCTM process standards appear throughout the book to indicate where the text relates to each of these. Practice exercises and activities and their explanations reinforce math concepts presented in the text and provide an opportunity for reflection and practice. Concise, conversational chapters and opening vignettes present math contents simply enough for even the most math-anxious pre-service teachers.

There has been a growing interest in the notion of a scholarship of teaching. Such scholarship is displayed through a teacher's grasp of, and response to, the relationships

between knowledge of content, teaching and learning in ways that attest to practice as being complex and interwoven. Yet attempting to capture teachers ' professional knowledge is difficult because the critical links between practice and knowledge, for many teachers, is tacit.

Understanding and Developing Science Teachers' Pedagogical Content Knowledge

Origin and Use of Pedagogical Content Knowledge

Exploring Science Teachers' Pedagogical Content Knowledge in the Teaching of Genetics in Swaziland

Expert Teacher

The Construct and its Implications for Science Education

Going Public

This dissertation, "Preservice Teachers' Development of Pedagogical Content Knowledge for Teaching Nature of Science Through a Progressive Video-based Reflection Task" by Mansum, Lo, [illegible], was obtained from The University of Hong Kong (Pokfulam, Hong Kong) and is being sold pursuant to Creative Commons: Attribution 3.0 Hong Kong License. The content of this dissertation has not been altered in any way. We have altered the formatting in order to facilitate the ease of printing and reading of the dissertation. All rights not granted by the above license are

retained by the author. Abstract: Teaching and learning Nature of Science (NOS) is becoming an increasingly important part of science education. Effective NOS instruction depends on teachers' Pedagogical Content Knowledge for teaching NOS (PCKnos). However, little is known about the characteristics of PCKnos, how it is developed, or the factors influencing that development. This study explores these aspects through a naturalistic study of the learning experiences of eight secondary school biology preservice teachers (PSTs) enrolled in a one-year Postgraduate Diploma in Education (PDGE) teacher

training course in Hong Kong. The PSTs' PCKnos development was traced by analysing the assignments they submitted to the course and the transcripts of two semi-structured interviews. The Video Reflection Assignment (VRA) was particularly informative. It required the PSTs to comment on the same set of videos at three different times: at the beginning, halfway through, and at the end of the PGDE course. The videos featured NOS instruction in one way or another. By analysing how the PSTs' comments on specific video episodes evolved over time, supplemented by the interview data, their PCKnos

development was documented. Factors influencing PCKnos development were identified mainly through the analysis of interview data. A new method, similar to the recently introduced PCK-map methodology, was created to visualize the findings. Among the five constituent components of the PSTs' PCKnos, their knowledge of instructional strategies was found to be the most developed, and their knowledge of assessment to be the weakest. The PSTs developed their PCKnos through progressive reflection on the same videos by drawing upon various experiences. Five factors

influenced this process: (1) PSTs' NOS understanding, (2) their prior learning and/or research experience, (3) their experience of attending the PGDE course, (4) their classroom teaching experience, and (5) the VRA. The VRA appears to be a potent tool for developing PSTs' PCKnos in two respects. First, the PSTs could utilize what they saw in the videos either as a source of experience on which to reflect, or to stimulate their reflections on newly acquired experiences. Second, the progressive nature of the VRA could deepen the PSTs' reflection, particularly with the aid of a theoretical framework in

later reflection tasks. The VRA was found to be helpful in overcoming three challenges to the development of PSTs' PCKnos: their weak understanding of NOS and of what constitutes effective NOS pedagogy, and the lack of school environments conducive to learning to teach NOS. PSTs may have few opportunities to observe others' effective NOS instruction or to experiment with NOS instruction themselves during their practicum; the videos in the VRA can play an important role in supplementing this lack of classroom experiences. It was further found that videos showing explicit-

reflective NOS instruction were more effective in developing PSTs' PCKnos than those showing implicit NOS instruction. To conclude, this study establishes that video-based progressive reflection tasks could be potent tools for developing PSTs' PCKnos, and makes recommendations on how to implement and refine these tasks. Implications for education policy and future research are also discussed. Subjects: Science - Study and
In The Expert Teacher: Using pedagogical content knowledge to plan superb lessons, Darren Mead presents an engaging, research-informed view on which

teaching strategies work best to induce long-term learning in students. 'But what does this look like in the classroom?' This question generally occurs to educators when they enquire into evidence-based approaches to teaching - and often they will get to the end of a teaching manual only to find that it remains unanswered. In The Expert Teacher, however, Darren Mead provides many of the answers. One of the most universally respected teachers in Britain, Darren has devoted his professional life to attaining pedagogical excellence. In this book he examines in depth what expert teachers do to help

students progress their learning and strive for academic success. He lays bare the concept of pedagogical content knowledge and eloquently explains how to utilise it to overcome student misconceptions, create contexts and connections in learning and teach difficult and important content - empowering educators to transform their sub-ject knowledge into multiple means of representing it in teachable ways. The intention of The Expert Teacher is to help teachers to reflect on what and how they plan, how they teach and how to improvise around these plans, and to pave the way for deep professional thinking

about best practice. It is split into two parts - entitled How is Your Subject Learned? and Expert Teaching and Learning - and provides educators with a variety of practical tools, illuminating examples and flexible frameworks geared to help them underpin and reinforce the very ampersand in expert teaching & learning. A warning though: this book is not for teachers seeking quick fixes or superficial tricks. The Expert Teacher is for educators who are eager to experience the excitement of knowing and teaching their subject masterfully. Suitable for all teachers in all settings.
This ambitious text is the first of

its kind to summarize the theory, research, and practice related to pedagogical content knowledge. The audience is provided with a functional understanding of the basic tenets of the construct as well as its applications to research on science teacher education and the development of science teacher education programs.

Research Paper (undergraduate) from the year 2010 in the subject Pedagogy - The Teacher, Educational Leadership, University of Twente , course: Education science, language: English, abstract: This article is focused on unveiling the concept of TPACK in relation to teaching

and learning in science and mathematics as well as the meaning of TPACK for pre-service science and mathematics teachers training. In describing this, different literatures were consulted on the meaning of TPACK, its origin and the way it can be integrated in pre-service science and mathematics teacher preparation. It was noted from literature that TPACK is the core of good teaching with technology, and that it's important for teachers to have an understanding of TPACK. Studies further show that the way pre-service teachers are taught to integrate technology, pedagogy and content is the

same way they can implement the approach in their own teaching. In addition, studies argue for pre-service teachers to learn on how technology can help to enhance students learning in science and mathematics rather than learning how to teach technology. Different frameworks have been proposed on how to shift from teaching technology to using technology to enhance learning. For example some studies provide the curricular plans for developing pre-service teachers' competencies of integrating technology pedagogy and content. To enhance pre-service teachers' competency in

technology integrations, some studies have reported the need for pre-service science and mathematics teachers to engage in the hands-on activities that reflect the real teaching with technology. Example of hands activities proposed in most studies includes planning of a lesson, presenting it to peers, getting critics from peers and re-planning it again. The cyclic development of the lesson is reported to enhance pre-service teachers' competency in working with technology in a real classroom situation. It is therefore concluded that implementation of TPACK in pre-service teachers training should

start with orientation of the pre-service teachers to the use of technology in teaching by providing them with sufficient opportunity to engage in hands-on activities.

Characterizing Middle Grade Mathematics Teachers' Technological Pedagogical Content Knowledge (TPACK) in Practice

Understanding and Developing ScienceTeachers' Pedagogical Content Knowledge

Re-examining Pedagogical Content Knowledge in Science Education

Effective Teachers' Pedagogical Content Knowledge in Teaching Quadratic Functions in

Mathematics

Powerful Ideas for Teachers

Handbook of Technological Pedagogical Content Knowledge (TPCK) for Educators

The 2nd edition of the Handbook of Technological Pedagogical Content Knowledge (TPACK) for Educators addresses the concept and implementation of technological pedagogical content knowledge—the knowledge and skills that teachers need in order to integrate technology meaningfully into instruction in specific content areas. Driven by the growing influence of TPACK on research and practice in both K-12 and higher education, the 2nd edition updates current thinking about theory, research, and

practice. Offering a series of chapters by scholars in different content areas who apply the technological pedagogical content knowledge framework to their individual content areas, the volume is structured around three themes: Current thoughts on TPACK Theory Research on Technological Pedagogical Content Knowledge in Specific Subject Areas Integrating Technological Pedagogical Content Knowledge into Teacher Education and Professional Development The Handbook of Technological Pedagogical Content Knowledge (TPACK) for Educators is simultaneously a mandate and a manifesto on the engagement of technology in classrooms. Published by Taylor & Francis

Group for the American Association of Colleges for Teacher Education This Handbook addresses the concept and implementation of technological pedagogical content knowledge -- the knowledge and skills that teachers need in order to integrate technology meaningfully into instruction in specific content areas. Recognizing, for example, that effective uses of technology in mathematics are quite different from effective uses of technology in social studies, teachers need specific preparation in using technology in each content area they will be teaching. Offering a series of chapters by scholars in different content areas who apply the technological pedagogical content knowledge framework to

their individual content areas, the volume is structured around three themes: What is Technological Pedagogical Content Knowledge? Integrating Technological Pedagogical Content Knowledge into Specific Subject Areas Integrating Technological Pedagogical Content Knowledge into Teacher Education and Professional Development The Handbook of Technological Pedagogical Content Knowledge for Educators is simultaneously a mandate and a manifesto on the engagement of technology in classrooms based on consensus standards and rubrics for effectiveness. As the title of the concluding chapter declares, "It ' s about time!" The American Association of Colleges for

Teacher Education (AACTE) is a national, voluntary association of higher education institutions and related organizations. Our mission is to promote the learning of all PK-12 students through high-quality, evidence-based preparation and continuing education for all school personnel. For more information on our publications, visit our website at: www.aacte.org.

This volume represents both recent research in pedagogical content knowledge (PCK) in science, technology, engineering and math (STEM), as well as emerging innovations in how PCK is applied in practice. The notion of "research to practice" is critical to validating how effectively PCK works within the clinic and how it

can be used to improve STEM learning. As the need for more effective educational approaches in STEM grows, the importance of developing, identifying, and validating effective practices and practitioner competencies are needed. This book covers a wide range of topics in PCK in different school levels (middle school, college teacher training, teacher professional development), and different environments (museums, rural). The contributors believe that vital to successful STEM education practice is recognition that STEM domains require both specialized domain knowledge as well as specialized pedagogical approaches. The authors of this work were chosen because of their extensive fieldwork in PCK

research and practice, making this volume valuable to furthering how PCK is used to enlighten the understanding of learning, as well as providing practical instruction. This text helps STEM practitioners, researchers, and decision-makers further their interest in more effective STEM education practice, and raises new questions about STEM learning. Research on teachers' professional knowledge hints at teachers' pedagogical content knowledge being an important criterion for instructional quality and student achievement. This research project investigates the relation between teachers' pedagogical content knowledge, teachers' actions, and students' content knowledge in physics comparing

Finland, Germany, and Switzerland.
An Analysis of Prospective Teachers ' Technological Pedagogical Content Knowledge
Practical Use of ICT in Science and Mathematics Teachers ' Training at DUCE
Technological Pedagogical Content Knowledge (TPACK) Framework for K-12 Teacher Preparation: Emerging Research and Opportunities
Exploring the Pedagogical Content Knowledge of Effective Teachers in Physical Education
The Influence of Secondary Science Teachers' Pedagogical Content Knowledge, Educational Beliefs, and Perceptions of the Curriculum on Implementation and Science Reform
Exploring, Developing, and

Assessing TPCK

The purpose of this study was to investigate how a professional development effort, which immerses teachers in learning science content by inquiry and models sound pedagogical practices, promotes change in teachers2 inquiry thoughts and actions. More specifically, the study first aimed to describe middle school science teachers2 beliefs and pedagogical content knowledge (PCK) for teaching middle school physical science. Second it examined how the Physics by Inquiry (PBI) course influenced their beliefs and PCK. And third, it investigated how the teachers' beliefs and PCK influenced their practice. Participants in this study consisted of teachers who took part in Physics by Inquiry and who taught physical science in middle grade

classroom following their participation. The study followed a qualitative case study design and made use of in-depth interviews and observations to examine teachers2 knowledge, beliefs, and practice. The study drew on the theoretical framework of a knowledge base for teaching, especially the construct of PCK to create interview questions and formulate initial coding categories for analysis. Findings from this study indicated that the teachers differed markedly in terms of their PCK and coherence among its elements. The PCK of the teacher with 23 years of teaching experience was less coherent and integrated than the teacher with 3 years of teaching experience. Furthermore, Physics by Inquiry influenced teachers' PCK in similar ways, namely their beliefs and knowledge about science teaching,

student learning, and instructional strategies. The translation of the teachers' PCK into their practice was mediated by several factors including contextual factors, beliefs about students, and concerns for coverage and control. Finally, the teachers2 PCK had roots in their early experiences with science, college content courses, teaching experience, and Physics by Inquiry.

This book enhances readers' understanding of science teachers' professional knowledge, and illustrates how the Pedagogical Content Knowledge research agenda can make a difference in teachers' practices and how students learn science. Importantly, it offers an updated international perspective on the evolving nature of Pedagogical Content Knowledge and how it is

shaping research and teacher education agendas for science teaching. The first few chapters background and introduce a new model known as the Refined Consensus Model (RCM) of Pedagogical Content Knowledge (PCK) in science education, and clarify and demonstrate its use in research and teacher education and practice. Subsequent chapters show how this new consensus model of PCK in science education is strongly connected with empirical data of varying nature, contains a tailored language to describe the nature of PCK in science education, and can be used as a framework for illuminating past studies and informing the design of future PCK studies in science education. By presenting and discussing the RCM of PCK within a

variety of science education contexts, the book makes the model significantly more applicable to teachers' work. This book enhances readers' understanding of science teachers' professional knowledge, and illustrates how the Pedagogical Content Knowledge research agenda can make a difference in teachers' practices and how students learn science. Importantly, it offers an updated international perspective on the evolving nature of Pedagogical Content Knowledge and how it is shaping research and teacher education agendas for science teaching. The first few chapters background and introduce a new model known as the Refined Consensus Model (RCM) of Pedagogical Content Knowledge (PCK) in science education, and clarify

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Teachers must have specific knowledge of a subject and how to teach it to promote learning in their students (also known as pedagogical content knowledge). Research has

shown that project-based curriculum can be an effective way for teachers to leverage this knowledge into deeper student understanding and application readiness, but observations about when and how this happens in the classroom have not been adequately documented. In this study we will explore teaching and learning in a middle-school boat-building curriculum focused on real-world application of math concepts. The boat-building program took place over one week, included seven students, and was taught by three teachers. The teaching phase of this study examined how the three boat-building teachers applied their pedagogical content knowledge (PCK) through a participant observation case study. The three teachers had diverse training and teaching backgrounds. At the

completion of the course these teachers were interviewed on their prior teaching experiences and training to determine how they acquired their pedagogical content knowledge. The learning part of this study involved a pre- and post-test application task completed by the students. After all students completed the application task, each was interviewed to see what, if any, knowledge or approach these teachers used had an impact on the ability of the students to do the task. Analysis of the pre-post assessments showed that students were not able to make statistically significant gains over the one week of instruction. However, students did note many aspects of instruction that they thought helped them. Additionally, students showed gains in assessing importance of geometry in design, the

vocabulary associated with scale, geometry, and woodworking, and creating context for prior instruction. For the teachers, higher scores on the PCK rubric did align with a greater amount of experience teaching. Also, the two more experienced teachers influenced each other and the third teacher regarding student learning and instructional approach.

TPACK for Pre-service Science and Mathematics Teachers

Developing Technological Pedagogical Content Knowledge

The Development of a Teacher Educator's Pedagogical Content Knowledge

Preservice Teachers' Development of Pedagogical Content Knowledge for Teaching Nature of Science Through a Progressive Video-Based Reflection Task

An Investigation of Primary Teachers' Mathematical Pedagogical Content Knowledge

Preservice Science Teachers' Pedagogical Content Knowledge for Nature of Science and Nature of Scientific Inquiry

Improving learning experiences for all students is the ultimate goal of research in technology use in education. With more availability and better usability of technology in schools, the potential for teachers to use digital tools in schools is greater than ever. However a key factor determining whether new technologies are adopted is the extent to which teachers know how to use them to support students' learning. The special knowledge of

how technologies can support students' learning of subject area content is known as technological pedagogical content knowledge (TPACK). This study explored the relationship of accomplished teachers' TPACK confidence to their use of technology with students and to their teaching and learning contexts. In an online survey, 307 National Board Certified teachers provided information about the frequency and breadth of their computer use with students; their use of computers in their personal lives; the school, classroom, and personal resources available to them for learning; and the people in their learning networks supporting their

learning to use new technologies for teaching. Although the representativeness of the sample was limited and the measures self-reported, they provided rich opportunities to discover relationships and suggest avenues for supporting teacher learning of new technologies. Analyses showed that these accomplished teachers' confidence in their knowledge of how to use new technologies for teaching was different from their confidence in using technologies more generally. Further, TPACK confidence related to student use of computers in the classroom. No associations were found between TPACK confidence and age, gender,

grade levels, subject areas, or student populations. However, confidence in teaching with technology did relate to measures of the teachers' learning resources. More varied learning resources and more productive social learning networks were associated with higher TPACK confidence. Three key types of support provided by learning partners -- learning together, posing challenges, and connecting the teacher to others to learn from -- were significantly more common among high-TPACK teachers. Findings in this study point to ways we might further understand, and subsequently increase, teacher confidence in using

new technologies to support student learning. Several questions are raised for future research: Do learning resources lead to confidence in knowledge, or does confidence lead to awareness of existing resources? To what extent can TPACK be measured without first assessing the teacher's PCK? And how might we develop survey measures that reliably capture the complexity of technological pedagogical content knowledge? Understanding TPACK and the conditions under which it develops is an important field of research, as we strive to help teachers learn to use new technologies effectively to support powerful student learning.

The purpose of this study was to describe the pedagogical content knowledge of a group of science teachers. Pedagogical content knowledge was characterized in terms of the teachers' knowledge of the structure, function, and development of their disciplines (biology, chemistry, and physics), and their understanding of the nature of science. Pedagogical content knowledge was then related to the teachers' level of education, years of teaching experience, and the class level(s) that they teach. Twenty science teachers were selected using purposive sampling procedures to participate in the study. However, seventeen teachers completed all

phases of this study. Teachers responded to a modified version of the Views on Science-Technology-Society questionnaire to assess their understanding of me nature of science. They then constructed concept maps mat were used to assess knowledge of the structure of their disciplines. Finally, they were interviewed to assess their understanding of the function and development of their disciplines. Responses to the questionnaire were categorized as reflecting idealistic or realistic views of the nature of science. The concept maps were scored on their validity, congruence, salience, and centrality of concepts. A wholistic score was also derived

for the concept maps. Clinical interviews were audio-tape recorded and transcribed then analyzed to assess teachers' understanding of the function of their disciplines in terms of the number of everyday life examples that they could provide. In these interviews, knowledge of the development of science was also assessed by first asking teachers to adapt their concept maps to the needs of younger students, then to explicate their knowledge of their students' alternative conceptions. The pedagogical content knowledge of the teachers who participated in this study was lacking in all respects. Teachers held several idealistic views about the nature of

science and did not demonstrate adequate understandings of the structure, function, and development of their disciplines. Moreover, teachers' pedagogical content knowledge did not relate to their years of teaching experience, the class level{s) that they teach, and their level of education. These results were discussed. It was reasoned that teacher preparation programs are not helping student-teachers to develop their pedagogical content knowledge. Recommendations for improving teacher education programs to help science teachers develop this pedagogical content knowledge as well as recommendations for further

research were presented.

In the field of TESOL, research in teacher cognition has contributed to a better understanding of teachers' mental lives and how they influence their teaching practices (Freeman & Johnson, 1998), yet little of this research has focused on L2 writing teachers (Borg, 2006). As a result, we know relatively little about the mental lives of L2 writing teachers (Hirvela & Belcher, 2007; Lee 2010), including what knowledge they possess and how they draw on and develop this knowledge in teaching practice. Furthermore, though the general education literature has theorized a bi-directional relationship between

teacher knowledge and teacher reasoning (Shulman, 1987), this relationship has not been adequately researched (Hashweh, 2005). There is a need, therefore, for research that examines the knowledge of L2 writing teachers and specifically how this knowledge develops in and through the activities of teaching. Operating from a sociocultural theoretical perspective (Vygotsky, 1986; Lantolf & Thorne, 2006; Johnson, 2009) and using a variety of data including interviews, concept maps, video recordings of classroom instruction, stimulated recalls, and instructional artifacts, this study examines the development of four L2 writing teachers'

pedagogical content knowledge (Shulman, 1987) over a semester of teaching. Overall, the findings demonstrate the highly contingent and emergent nature of teachers' PCK. As the writing teachers planned, taught, and reflected on their teaching, both their underlying content knowledge and pedagogical content knowledge developed in overlapping ways. Moreover, this development was mediated by a variety of factors. Among these factors, teachers' underlying value-laden conceptions of writing and teaching, the required first-year writing curriculum, their students' emerging understandings of the content they were teaching, and the

activities and interactions involved in the research methodology all mediated the teachers' developing conceptualization of the content of the class and how to teach it to this particular group of students.

In the past decades wide-ranging research on effective integration of technology in instruction have been conducted by various educators and researchers with the hope that the affordances of technology might be leveraged to improve the teaching and learning process. However, in order to put the technology in optimum use, knowledge about how and in what way technology can enhance the instruction is also essential. A number of theories and

models have been proposed in harnessing the technology in everyday lessons. Among these attempts Technological and Pedagogical Content Knowledge (TPACK) framework introduced by Mishra and Koehler has emerged as a representation of the complex relationships between technology, pedagogy and content knowledge. The TPACK framework extends the concept of Shulman's pedagogical content knowledge (PCK) which defines the need for knowledge about the content and pedagogical skills in teaching activities. Since then the framework has been embraced by the educational technology practitioners,

instructional designers, and educators. TPACK research received increasing attention from education and training community covering diverse range of subjects and academic disciplines and significant progress has been made in recent years. This book attempts to bring the practitioners and researchers to present current directions, trends and approaches, convey experience and findings, and share reflection and vision to improve science teaching and learning with the use of TPACK framework. A wide array of topics will be covered in this book including applications in teacher training, designing courses,

professional development and impact on learning, intervention strategies and other complex educational issues. Information contained in this book will provide knowledge growth and insights into effective educational strategies in integration of technology with the use of TPACK as a theoretical and developmental tool. The book will be of special interest to international readers including educators, teacher trainers, school administrators, curriculum designers, policy makers, and researchers and complement the existing literature and published works.

A Case Study of Three Math Teachers and Their Students

The Development of L2 Writing
Teachers' Pedagogical Content Knowledge in Teaching Activity
Pedagogical Content Knowledge in STEM
Elementary Mathematics
Pedagogical Content Knowledge
Research to Practice
Implications for Teaching

There has been a growing interest in the notion of a scholarship of teaching. Such scholarship is displayed through a teacher ' s grasp of, and response to, the relationships between knowledge of content, teaching and learning in ways that attest to practice as being complex and interwoven. Yet attempting to capture teachers '

professional knowledge is difficult because the critical links between practice and knowledge, for many teachers, is tacit. Pedagogical Content Knowledge (PCK) offers one way of capturing, articulating and portraying an aspect of the scholarship of teaching and, in this case, the scholarship of science teaching. The research underpinning the approach developed by Loughran, Berry and Mulhall offers access to the development of the professional knowledge of science teaching in a form that offers new ways of sharing and disseminating this knowledge. Through this Resource Folio approach (comprising CoRe and PaP-eRs) a recognition of the

value of the specialist knowledge and skills of science teaching is not only highlighted, but also enhanced. The CoRe and PaP-eRs methodology offers an exciting new way of capturing and portraying science teachers ' pedagogical content knowledge so that it might be better understood and valued within the profession. This book is a concrete example of the nature of scholarship in science teaching that is meaningful, useful and immediately applicable in the work of all science teachers (preservice, in-service and science teacher educators). It is an excellent resource for science teachers as well as a guiding text for teacher education.

Understanding teachers' professional knowledge is critical to our efforts to promote quality classroom practice. While PCK offers such a lens, the construct is abstract. In this book, the authors have found an interesting and engaging way of making science teachers' PCK concrete, useable, and meaningful for researchers and teachers alike. It offers a new and exciting way of understanding the importance of PCK in shaping and improving science teaching and learning. Professor Julie Gess-Newsome Dean of the Graduate School of Education Williamette University This book contributes to establishing CoRes and PaP-eRs as immensely valuable tools to

illuminate and describe PCK. The text provides concrete examples of CoRes and PaP-eRs completed in "real-life" teaching situations that make stimulating reading. The authors show practitioners and researchers alike how this approach can develop high quality science teaching. Dr Vanessa Kind Director Science Learning Centre North East School of Education Durham University

Using pedagogical content knowledge to plan superb lessons

Repositioning Pedagogical Content Knowledge in Teachers' Knowledge for Teaching Science

Emerging Research and Opportunities

Multiple Perspectives

Technological Pedagogical Content Knowledge