International Journal of Research ISSN NO:2236-6124

Pedagogical Content Knowledge: Innovative Instructional Strategy for Science Classrooms and Professional Development Programmes

Renjith J S[1], Dr. V.P Joshith[2]

[1]Ph.D Research Scholar, Research and development centre, Bharathiar University, Coimbatore.
[2]Research supervisor, Assistant professor, Department of Education, central university of Kerala, Kasargode
1 renjith13639@gmail.com, 2 getjoshith@gmail..com

Abstract: Knowledge explosion take place in this world everywhere. Each and every moment lot of knowledge is accumulating in every branch of study and this process of accumulation of knowledge is never ending. Educational system depends on the quality of teachers who transfer diversified forms knowledge to students. In this dynamic world teacher is one among the educational resources in the field of education. Teacher role in educational process is inevitable. The quality of education mainly depends on the quality of teachers. Education is a process by which new ideas, thoughts are developed in the mind of students that help them to solve the problems in life. Pedagogical content knowledge is considered as a component of knowledge of subject matter. Pedagogic content knowledge (PCK) is the proper blending of content and pedagogy, the two of the important elements for teaching. PCK is a complex construct which include a lot of models and components. There are different forms of pedagogical content knowledge namely technological pedagogical content knowledge (TPACK) and web pedagogical content knowledge (WPCK). This article discuss about Pedagogical content knowledge as construct, the process of its development, importance, the different models of PCK.

Keywords: Pedagogical content knowledge, pedagogical knowledge, curriculum knowledge, content knowledge, Web pedagogical content knowledge, Technological pedagogical content knowledge.

Introduction

Teaching Competence is not a simple and immediate process which is acquired by teachers directly in their teacher education period but it is a complex, dynamic and ever modeling process which takes place through various forms of training, interactions and through discourses which takes place when one being inducted as teacher or in direct sense it can be said that, this is what a teacher acquires through various programmes during pre-service and in-service periods. For a teacher to be confident and enthusiastic, in particular, subject teaching knowledge about the classroom competencies and field learning is required. By using different instructional strategy, professional competence can be developed among teachers. Pedagogical Content Knowledge (PCK) is an innovative instructional strategy in education which attracts the learners, as it includes different knowledge integration syntax related to learning and teaching. Pedagogical knowledge is essential for a teacher to transact her lesson in classroom. Pedagogical content knowledge help the teacher to know the different techniques employed in teaching and learning.

quality of an educational system depends on the quality of teachers who transfer knowledge to students. In this ic world teacher is one among the educational resources. Teacher's role in educational process is inevitable. quality of education mainly depends on the quality of teachers. Education is a process by which new ideas, hts are developed in the mind of students. Pedagogical content knowledge is considered as a component of ledge of subject matter. PCK is the mixing of content and pedagogy which is an important element for ng. It is one of the features of teacher's knowledge which include how to teach a topic. Teaching and learning ntirely different. Some teachers have a good content knowledge but find it difficult to teach in a classroom. comes the importance of PCK. It is an important term which needs to be discussed very widely in ctional technology focusing on direct teaching.

gogical Content Knowledge (PCK) is developed mainly by professional teachers because experience plays an tant role. Through experience we can understand a lot of matters in teaching. A teacher at beginning is nt from last days of service because experiences make him more perfect than in older days. It is an important f a knowledge required for teachers in a complex and varied setting especially to deal with the more tent students of today's classrooms. PCK is developed through long time discussions, trail and exposure in ttings blending with experience which help a teacher to understand how to teach a topic which enhances r's learning. PCK is not same for every teacher and for same subject. It varies with in the subject and teachers ach the same subject. PCK improves the professional development by the intermixing of content knowledge dagogical knowledge. Success of students depends mainly on what teacher knows and how it is imparted to ts. PCK is a knowledge transfer strategy which can be developed through proper training.

ogical Content Knowledge (PCK)

Pedagogical content knowledge is varying among individual. It will be different among a laboratory chemist emistry teacher who plans and prepare their lesson. A chemist can tell students about the topic but a teacher r planning help to understand how students learn best and what they need. Pedagogical content knowledge es subject matter of particular discipline and teaching. Teacher should have an ability to blend content dge and pedagogy of the subject. Pedagogical content knowledge is domain specific. Pedagogical content dge consists of seven categories and in these seven categories, three is related to knowledge domain which curriculum knowledge content knowledge and pedagogical content knowledge. The next four include pedagogy, characteristics of learner, educational context knowledge and knowledge of education. gical content knowledge is the transformation of content knowledge so that it helps in the communication teacher and learner in classroom. The other elements of pedagogical content knowledge which are not aken for discussion are knowledge of learning difficulties and knowledge of subject matter. Pedagogical knowledge includes content knowledge, pedagogical knowledge and knowledge of context. The Concept s first stated by Lee Shulman (1986), a teacher education researcher trying to expand teacher and teacher ion to give scientific understanding to classroom strategies. Shulman define Pedagogical content knowledge pretation of teacher's content knowledge and transformation of this to facilitate learning of students. He d 7 elements of Pedagogical content knowledge. They are

Subject matter Knowledge (SK)

Subject matter knowledge is actually the content knowledge of the topic teacher discuss in the classroom. Content knowledge has to be developed first about the topic before taking up any task of teaching. It forms the base for all. There are 4 elements in subject matter knowledge. Content knowledge includes the facts, concepts, principles, theories and illustrations about a topic. Substantive knowledge includes paradigm and explanatory structure. Syntactic knowledge describes the method and process by which new knowledge in the field is developed.

General Pedagogical Knowledge (GPK)

It represents the knowledge of teacher about principles and strategies which are designed to facilitate management, organization and instruction in classroom. It is a general knowledge in teaching and not subject specific. The use of pedagogical knowledge in class room depends on the pupil which the teacher is handling. This gives the understandings on conventional teaching processes taking place in the classroom on different subjects.

Pedagogical Content Knowledge (PCK)

It involves knowledge of subject for teachers and how it is translated into classroom settings. PCK gives emphasizes to the understanding and representation of content matter knowledge for the purpose of classroom teaching. PCK developed by Shulman depends mainly on two factors namely, representation and understanding. In general PCK is the integration of understanding of subject matter knowledge, teaching techniques and knowledge of student's development.

Curricular knowledge

Curricular knowledge includes the knowledge of the basic curriculum ideas like foundation of curriculum, principles of curricular development, curriculum types and its structure. Curriculum includes all experience gained from school through curricular, co-curricular and extracurricular activities. It also includes the basic understandings about the learners and objectives of transacting something to them.

Importance of PCK

For teaching to be successful, teachers should be able to transform the subject matter knowledge into PCK in order to enhance student's learning. The knowledge domain of teacher and knowledge in the specific subject they are handling becomes the important at this stage. In addition to this knowledge about learners characteristics, which include their developmental task, problems of their age group, motivations and others are also included in PCK. Pedagogical knowledge which include the principles of classroom management through contextual knowledge where learning takes place. PCK is the mixed form of content matter and pedagogy. It is not the content and pedagogy contributes to PCK but the intersection of both to transform content into pedagogical tools. PCK is the amalgam of content and pedagogy to understand the organization, adaptation and representation of knowledge in the instructional process. PCK is considered as the knowledge of content dealing with process of teaching which includes representing and formulating subject to make it comprehensible to others.

PCK Models

Pedagogical Content Knowledge (PCK) is a complex construct which include a lot of models and components. Grossman (1990) developed a PCK model with four components namely instructional strategy knowledge, knowledge of curriculum, knowledge of students understanding, subject matter knowledge. Main three components of PCK are curriculum knowledge, content knowledge and pedagogical knowledge. Magnusson et.al (1999) developed a PCK model which consist of five components namely science teaching orientation, science curriculum knowledge, knowledge of students understanding of science, knowledge of instructional strategy and knowledge of assessment of scientific literacy.

onsist of two types of knowledge namely declarative knowledge and procedure knowledge. There are types of pedagogical content knowledge namely technological pedagogical content knowledge and web gical content knowledge.

dagogical content knowledge consist of four components namely pedagogical content knowledge ,web gical knowledge, web content knowledge, web pedagogical content knowledge. Web pedagogical knowledge knowledge of web by teachers for different topics taught in the class. Web content knowledge refers to the of content with properties and advantages of web. Web pedagogical content knowledge refers to giving tion using web teaching the topic and integration of content and web properties. Technological pedagogical knowledge includes pedagogical knowledge, technological knowledge, pedagogical content knowledge, logical pedagogical knowledge, and technological content knowledge. Technological knowledge includes the dge of using hardware, software information technology tools. Technological pedagogical knowledge is the dge of change in teaching and learning when a specific technology is used. Technological content knowledge knowledge of how technology is used for content development how to visualize a content and knowledge of chnologies are related to field.

logical and pedagogical content knowledge is teaching with the help of technology. The use of technology is ss among teachers. A fear to use the technology develops the mind of teachers. Integration of technology to ld of education is a complex task which was practiced through ill structured models. Technological gical content knowledge includes different forms of knowledge for integrating technology in classroom and hing. Technological and pedagogical content knowledge mainly includes pedagogy, content and technology. nt covered in upper primary science curriculum is different from high school or higher secondary curriculum. nt to be taught should be familiar to teachers and it is the most important matter in transactional processes, t content knowledge these models fails. It is the interaction between the three knowledge forms of TPACK. CK help the researcher to conduct researches in the area of technology use of teachers, professional pment of teachers, and effect in teacher education. Teaching with technology is not a simple task. It requires g experience in the field of education and technology. A sound knowledge of TPACK is very essential for rs to excel in the field. Teaching profession is highly competitive. A teacher cannot continue his/ her whole g period with a single strategy. Use of technology help to increase interest and motivation among students. fective learning to take place content taught must be understand to students.

opment of PCK

PCK developed as an integration of subject matter and pedagogical knowledge which is used in classroom. n service or pre-service teachers have no understandings on the application of PCK. So training models should veloped and initiated at teacher's level onwards. PCK development is a complex and non linear process. er education is not sufficient to provide over all training in PCK components. For the development of PCK t matter knowledge is the prerequisite and teaching experience is the source of PCK. PCK development s by subject matter role, teaching experience, focusing student learning and the design of teacher education. ers during their pre-service training have limited content knowledge and development of PCK is very difficult. eachers with thorough content knowledge do not contribute to high PCK. When unfamiliar topics are taught sroom teachers use their general Pedagogical knowledge.

For pre-service teachers teaching experience will be there or not they lack pedagogical content knowledge. Self confidence and ability to teach forms a hindrance to PCK. Pre-service teachers cannot be efficiently relates subject matter knowledge to previous knowledge and students conceptions. Pre-service teachers find difficulty in merging content knowledge and education course which are not integrated by design. **Studies related to PCK**

Garritz (2010) studied affective domain of teaching learning and relation to PCK. It shows a dependence between the affective domain of learning and teaching. Kleickmann & Richter & Kunter (2010) studied how teacher content knowledge and Pedagogical content knowledge form structural difference in teacher education. Okanlawon (2010) studied a framework for teaching reaction Stoichiometry using pedagogical content knowledge. Sahin Ismail (2011) conducted a study on development of Pedagogical content knowledge. Aydin & Boz (2012) conducted a review of studies in Pedagogical content knowledge in science education. Banegas (2012) studied Pedagogical content knowledge in English teacher education programme. Lange. Kleickmann. & Moller (2012) studied the relation between student's achievement and PCK in science education. McCray. & Chen (2012) conducted a study on PCK of preschool mathematics and construct validity of teacher interview. Nuang Chalerm (2012) conducted a study to find out how PCK can be enhanced in pre-service teachers. Seung (2012) studied physics graduate teacher PCK for teaching new physics curriculum. Van Driel & Berry (2012) studied how PCK enhance teacher' professional development. Yesilder & hatice (2012) studied how PCK of prospective teachers develop for numbe pattern in school curriculum. Strube , Troger., Tepner. & Sumflrth (2014) developed a PCK test in chemistr language and models. Olfos , Goldrine . & Estrella (2014) studied teachers PCK and how it is related to student understanding. Bobin Antony & Annaraja (2007) studied the awareness of information and communicatio technology and PCK of prospective teachers. Kwong & Joseph (2007) conducted a study to find out th development of pedagogical content knowledge of prospective teachers. Chick & Harris (2007) conducted a stud to find out the relation of PCK and use of example for teaching ratio. Goognoudh & Hung (2007) conducted study to enhance PCK of teachers by adopting nine step problem based learning model. Wobbe de (1998) conduted a study to find how Pedagogical content knowledge varies within science teaching context.

PCK in Science Teacher Training

In the present scenario of teacher education knowledge is directly transferred from the educator t prospective teachers. This is a top- down approach which does not allow the prospective teachers to develop knowledge base in science teaching as they do not get any chance for the learning in active way. Some find difficult in using instructional strategy for the enhancement of reasoning in prospective teachers. Action research is one o the tool which fit the scene. What is taught in teacher education course does not always fit to classroom teaching Present pre-service programme recommend to use student centered teaching strategies instead of teacher centere strategies. Prospective teachers understand that best teaching strategy is teacher centered. When they start teachin they understand expository teaching is more useful. There is a conflict between observed and expected teachin strategies among prospective teachers. There will be no matching between strategies taught and applied b prospective teachers in classroom. There is a gap between teaching course theory and classroom teaching practice For this three steps are recommended. They are first evaluation of pedagogical event should be done. Conduct th action research. Second step involves presenting and discussing. Last step is the personal evaluation of pedagogica problem.

Conclusion

Pedagogical content knowledge has now become a topic for research. It has wide spread popularity. ent forms of Pedagogical content knowledge namely web Pedagogical content knowledge and technological gical content knowledge has emerged. A variety of studies are conducting in the area of Pedagogical content edge and types too. Pedagogical content knowledge should be enhanced through training at pre-service level. per program to develop Pedagogical content knowledge should be done at teacher training courses. ation program, courses can be organized to develop Pedagogical content knowledge. Pedagogical content edge is an important term in education and for teachers as it provides overall development of teachers. ers develop Pedagogical content knowledge through their experience.

erences

S & Boz ,Y.(2012) Review of studies related to PCK in the context of science education: Turkish case. Educational science: & practice, 12,497-505

D. (2012) Pedagogical content knowledge in English teacher education. Teaching and Teacher Education.22, 200-215

Antony & Annaraja. (2007) Awareness of information and communication technology and Pedagogical content knowledge of ive teachers. International Journal of Science Education, 8, 45-59.

H.L & Haris, K. (2007) A study on Pedagogical content knowledge and the use of examples for teaching ratio. CH107286. F.Frdmantle.Retrieved from http://publications.aare.edu.au/07pap/chi07286.pdf

A.(2010) . A study on Pedagogical content knowledge and the Affective domain of scholarship of teaching and learning. ional Journal of the scholarship of teaching and learning, 4,45-50

udh, K.C & Hung,W. (2007) Engaging teacher's PCK by adopting a nine step problem based learning model, Interdisciplinary of Problem solving ,2,25-30.

an, P. L. (1990). The making of a teacher: Teacher knowledge and teacher education. New York: Teacher College Press.

mann, T & Richter, D & Kunter, M. (2010) Teacher's content knowledge and Pedagogical content Knowledge and the role of al difference in the teacher education, Journal on teacher education, 64,90-106.

K, Kleickmann, T & Moller .K .(2012) Elementary teacher's Pedagogical content knowledge and student's achievement in ducation. International Journal of science education,30,258-269.

n, J.S & Chen, J.Q.(2012) Pedagogical content knowledge for preschool mathematics construct validity of a new teacher w, Journal of Research in childhood education, 26, 52-60.

Chalerm . (2012) Enhancing Pedagogical content knowledge in pre service science teachers. Journal of higher education 14,147-152.

lawon, A.E. (2010) Constructing a framework for teaching reaction Stoichiometry using Pedagogical Content Knowledge. tional Journal of science education,35, 125-135.

Goldrine .T & Estrella .S. (2014) Teachers PCK and its relation with students understanding. Journal of interactive online 4,72-86.

tilsmail (2011) Development of survey Technological Pedagogical and Content Knowledge, the Turkish Journal of Educational logy,10,22-29.

E . (2012) Examining Physics Graduate Teaching Assistant's Pedagogical content knowledge development. International of science and mathematics education.11,1303-1326

o:S

- *Shulman, L. S. (1986) Those who understand: knowledge growth in teaching. Educational Researcher 15(2), 4-14*
- *Shulman, L. S. (1987) Knowledge and Teaching: foundation of new reform, Harvard Educational Review 57, 1-22.*
- *Strube .M, Troger.H, Tepner.O & Sumflrth .E (2014) Development of a PCK test of chemistry language and models. International journal on education.7(9), 980-990.*
- *Van Driel .J.H & Berry .A (2012) Teachers professional Development on Pedagogical content knowledge, Educational Researcher,24,178-182*
- *Yesilder , T & Hatice, K .(2012) Investigation on the development of prospective mathematics teachers Pedagogical content knowledge of generalizing number pattern through school practicum. International journal of Mathematics education in science and tehnology, 47,245-260.*