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IN-SERVICE SCIENCE TEACHER PROFILES FROM THE EYES OF PRE-SERVICE SCIENCE TEACHERS: WHAT DID THEY OBSERVE?

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ABSTRACT: The purpose of this study is to portray in-class implementations of in-service science teachers from the eyes of the pre-service science teachers. Specifically, this study examines various science teaching components such as overcoming misconceptions, assessment of science learning, integrating nature of science aspects, using different science teaching methods etc. that science teachers use during instruction. Additionally, classroom management strategies of science teachers are also included. The data are obtained from the observations of pre-service science teachers. Thirty three pre-service and thirteen in-service teachers participated in the study. The observation protocols that pre-service science teachers filled will be analyzed to document the findings. A content analysis approach and descriptive statistics were used for the data analysis. The data revealed that science teachers have low levels of PCK and they generally use traditional teaching methods, strategies and traditional assessment techniques. Their NOS understandings are limited and classroom management strategies rely on discipline.

Key words: Pre-service science teachers, in-service science teachers, practice teaching course, science teaching

INTRODUCTION

Research on PCK has been common in science education since 20 years (Abell, 2008). The term was proposed by Shulman (1986, 1987) that is special mixture of pedagogical knowledge and content knowledge where none of these two components are sufficient to be a good teacher. Therefore, it is very important to teach any specific topic by use of suitable teaching strategies and assessment techniques. Shulman (1986) also claimed that students' understandings should be cared by the teacher where teachers transform their academic science knowledge into school science.

After Shulman claimed his ideas about teaching, others proposed different explanations for their PCK views (Grossman, 1990; Cochran et al. 1993; Magnusson et al. 1999; Veal & MaKinster, 1998). Kind (2009) reported that different theoretical explanations for PCK can be categorized by two different main models in terms of transformative models and integrative models. Transformative models claim that content knowledge and PCK are different knowledge domains. According to transformative models there is a mechanism that teachers transform their content knowledge into PCK. On the other hand, integrative models see content knowledge as part of PCK. Integrative models are lack of explaining the mechanism for PCK formation. According to integrative models, PCK develops by experience.

One of the most used PCK model is the Magnusson et.al (1999) PCK model. This model was inspired by Grossman (1990) study. According to this model, PCK has five different components in terms of orientation towards science teaching, knowledge of curriculum, knowledge of learner, knowledge of assessment, and knowledge of instructional strategies. Orientation towards science is about beliefs and attitudes towards science and this component shapes and controls other PCK components.

Due to fact that PCK develops with experience and it is a dynamic knowledge domain (Abell, 2008; Aydın & Boz, 2012) pre-service teachers have little or no PCK. However, most of the PCK studies were conducted with pre-service teachers too. On the other hand, number of the PCK studies that use in-service teachers as sample

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were less than studies examining pre-service teachers' PCK. Comparing with pre-service teachers, in-service teachers have better PCK because of their experience.

Teacher PCK was generally little according to previous studies, therefore science educators developed tools such as content representation tools and managed professional development programs in order to increase science teachers' PCK. Professional development studies which last long term were found successful in literature.

Content knowledge and PCK are also investigated by researchers. Researchers examined the relationship between these different knowledge domains. Content knowledge has two subcomponents in terms of substantive knowledge and syntactic knowledge. Substantive knowledge is related with theories, principles, concepts and their relationship with each other. On the other hand, syntactic knowledge is related with how the scientific knowledge is gained and developed and characteristics of knowledge. Syntactic knowledge refers to nature of science (Khalick et al., 1997). Studies found different results from each other both for the relationship between substantive knowledge and PCK and syntactic knowledge and PCK. Some researchers claimed that there is a positive relationship between content knowledge and PCK, some others found blurred relationship between content knowledge and PCK, and some science educators found no relationship between content knowledge and PCK as reported in Kind (2009) study.

Finally, researchers examined the interaction between PCK components. For example, Hanuscin et al. (2010) found that teacher knowledge of learner is affected by knowledge of assessment because better assessment let teachers to understand difficult points of students' understandings. In addition, knowledge of learner affects teacher knowledge of instructional strategies directly. When teachers know students' needs better, they prefer appropriate teaching strategies for selected topic. This result showed that teachers' PCK components are closely related with each other and researchers suggested studying all components of PCK instead of focusing of only one or some components of PCK.

In line with the related literature, the aim of this study is to portray in-class implementations of in-service science teachers from the eyes of the pre-service science teachers. Specifically, this study examines various science teaching components such as overcoming misconceptions, assessment of science learning, integrating nature of science aspects, using different science teaching methods etc. that science teachers use during instruction. Additionally, classroom management strategies of science teachers are also included.

METHOD

This study is a qualitative study in nature. In order to get detailed information about the in-class implications of science teachers, pre-service science teachers have made observations during their practice teaching course. In this course, they observe mentor teachers and make several presentations throughout the semester. For the purpose of this study, they were provided with observation protocols before they go to schools for observations. Thirty three pre-service and thirteen in-service teachers participated in the study. The observation protocols that pre-service science teachers filled were analyzed to document the findings. A content analysis approach and descriptive statistics were used for the data analysis.

Data Analysis Procedure

The data is gathered from the answers of pre-service science teachers to the questions of observation protocol. Then related codes and categories were formed depending on the PCK studies found in literature. The observation protocol includes questions about science teaching orientation, knowledge of curriculum, knowledge of learner, knowledge of assessment, knowledge of instructional strategies. In addition, science teachers integrating nature of science aspects and classroom management strategies are examined.

RESULTS and FINDINGS

Results of the study showed that 84 % of the teachers preferred teacher centered orientation to science teaching such as didactic and academic rigor. Only 24 % of teachers adopted constructivist orientation such as guided inquiry. Teachers were successful for understanding of their students' prior knowledge and misconceptions. 54 % of participants both mentioned students' prior knowledge and identified their misconceptions. On the other hand, 32 % of the participants didn't talk about student's prior knowledge and their misconceptions. Teachers

were generally informed about knowledge of curriculum. For example; 42 % of them covered the objectives related with STS, SPS and content knowledge. Similarly, 42 % of the participants noted SPS and content knowledge objectives in their teaching. Another aim of this study is to understand whether teachers integrate NOS into their teaching. Findings showed that teachers either don't mention NOS by 45 % or mentioned only one or two aspects of NOS such as tentativeness, theory laden or cultural embeddedness of NOS. Teachers' teaching strategies were found parallel to their orientation towards science all of the teachers in this study preferred direct instruction and questioning. In addition, 54 % of them used experimenting and 22 % of teachers used demonstration. Few of the participants used contemporary teaching strategies such as inquiry (8 %), cooperative learning (8 %), analogy (8 %), project based learning (8 %). As their assessment techniques, teachers either didn't assess their students (38 %) or used traditional assessment techniques such as giving homework to students (62 %), making quizzes (15 %). On the other hand only few of the teachers used alternative assessment techniques correspondingly concept mapping (8 %), performance based assessment (8 %). Contextual knowledge is another aspect of this study. Pre-service teachers reported that their mentor teachers usually were not aware of the school environment, students need in and out of school as contextual knowledge. Only 42 % of the teachers were informed about the contextual factors such as school and students' parents. Final aspect of our study was based on how teachers manage their classrooms. Result of this study showed that 85 % of the teachers used strict rules for classroom management as disciplinary teachers. Moreover, 27 % of the teachers used their gestures to manage their classes. On the other hand only 30 % of the teachers were friendly towards their students to manage their classes.

CONCLUSIONS

This study aimed to portray the in-class implementations of science teachers. By examining the components of PCK it was aimed to present the current situation in terms of teaching science. In conclusion, this study showed that teachers were insufficient for their PCK in general depending on their orientation towards science, knowledge of curriculum, knowledge of assessment and knowledge of instructional strategies. In addition, these teachers were not successful to transform their NOS views into their teaching. Teachers' contextual knowledge and classroom management skills were also found inadequate depending on the views of pre-service teachers.

RECOMMENDATIONS

According to the finding of the study participating science teachers have little PCK. Therefore, programs that can develop their PCK may be beneficial. Additionally, workshops and end-of-semester seminars may be designed to foster their PCK. In terms of their classroom management strategies, teachers generally prefer to use traditional techniques. Seminars related to motivation may be useful to make teachers alter their discipline approach to motivating to learn science.

REFERENCES

Abell, S.K. (2008). Twenty years later: Does pedagogical content knowledge remain a useful idea? *International Journal of Science Education*, 30(10), 1405-1416.

Aydın, S., & Boz, Y. (2012). Review of studies related to pedagogical content knowledge in the context of science teacher education: Turkish case, *Educational Sciences: Theory and Practice*, 12(1), 497-505.

Cochran, K.F., DeRuiter, J.A., & King, R.A. (1993). Pedagogical content knowing: An integrative model for teacher preparation. *Journal of Teacher Education*, 44(4), 263-272

Grossman, P. (1990). *The Making of a Teacher*. New York: Teacher College Press.

Kind, V. (2009). Pedagogical Content Knowledge in Science Education: potential and perspectives for progress. *Studies in Science Education*, 45 (2), 169-204.

Hanuscin, D. L., Lee, M. H., & Akerson, V. L. (2010). Elementary teachers' pedagogical content knowledge for teaching the nature of science. *Science Teacher Education*, 145-167.

Khalick, F.A., & BouJaoude, S. (1997). An explanatory study of the knowledge base for science teaching. *Journal of Research in Science Education*, 34(7), 673-699.

Magnusson, S.J., Borko, H., & Krajcik, J.S. (1999). Nature, source, and development of pedagogical content knowledge for science teaching. In J. Gess- Newsome & N. Lederman (Eds.), *Examining Pedagogical content Knowledge* (pp.95-132). Boston, MA: Kluwer Press.

Veal, W.R. & Makınster, J.G. (1998). Pedagogical content knowledge taxonomies *Electronic Journal of Science Education* available at

http://unr.edu/homepage/crowther/ejse/vealmak.html (accessed 31.01.2014)