

## PERCEPTION OF PRESERVICE SCIENCE TEACHERS IN THE CONSTRUCTIVIST SCIENCE LEARNING ENVIRONMENT

<sup>1</sup>Prasart Nuangchalerm, <sup>2</sup>Jiří Dostál

<sup>1</sup>Maharakham University – Thailand

<sup>2</sup>Palacký University in Olomouc – Czech Republic

**Abstract.** Science learning was affected by various kinds of sources which students perceived and participated in classroom. The purpose of this study aims to investigate the science learning environment of preservice science teachers from Thailand and Czech Republic. Data were collected from 72 Czech and 37 Thai preservice science teachers by the six-element of CLES questionnaire. Findings revealed that preservice science teachers from Czech and Thai contexts had different level of constructivist science learning environment which is concerned classroom learning environments, and knowledge base for applying constructivist teaching into classroom. This may have implications for enhancing constructivist teaching in school context.

*Keywords:* learning environment; constructivist; CLES; national study

### Introduction

Teacher is the professional decision making in classroom activities, a key success to effective in science teaching and learning. Teacher preparation program is a part of performing competence teachers into changing sociocultural of various school contexts. In addition, school practicum seems to preservice teachers in which a place of implementation their authority of experience in decision making, controlling students' behavior, creating flexible instructional activities, developing constructivist learning environments, and shaping in their professional experiences. The most preservice teachers have been subjected to the authority of reason and the authority of position and are influenced by these authorities that tell them what to do and what to believe (Prachagool et al., 2016). Teacher preparation program need to prepare teacher candidates for changes in modern society and knowledge-based society.

The challenge for teacher preparation program is to help new teachers recognize and identify the place and function of the authority of experience. They have

to learn creating classroom environments which it meets the real need of students, current of instructional reform, and nature of 21<sup>st</sup> century learning. Decision making to constructivist learning environments cannot be ignored in the program because they have to bring it to professional experiences and consider as well as pedagogical, psychological, and philosophical implementations. Due to, constructivist view is powerful knowledge about natural world, understand how it changes and live with others critically (Duit & Treagust, 1995). In response to this challenge helping preservice teacher to understanding and offering the guidelines for teacher education by their university course work and practicum in school (Clift & Brady, 2005; Grisham et al., 2000). The goal is to have the teacher candidates not only see the relevance and importance of their studies, but also reflect critically since those studies have immediate causal effect on their present pedagogical and managerial contexts as professional teachers (Gruenewald, 2003). The changing world is now making science classroom and learning environment seem to be differenced. Preservice teachers must be adapted to have suitable ways that promotes constructivist learners.

Science learning aims to help students understand about theoretical and practical ways which scientists do, experiment, explore, explain, conclude, and present (Osborne, 2011). The process of science what students should be (a) asking questions and defining problems, what happens and what exists, why does it happen, and how do we know; these questions are starting point investigate and explore of what they want to know; (b) models should be developed to reflect of what they know and understand about natural world. It should be simplified to others when students communicate science; (c) planning and carrying out investigations are need to science learning. The successful in science is not only academic aspect, but also planning to investigate is a starting point of view in all scientists to explain their discoveries; (d) analyzing and interpreting data are crucial process formulating to science communication. Bias is prohibited for science experiment and discovery; (e) using mathematical tools for explaining, predicting, estimating, and presenting; (f) Constructing explanations are significance to science educators, it must be skilled disseminating science to classroom. Communicating through various kinds of methods such as website, journal, seminar, conference, symposium, and etc.; (g) engaging in argument from evidence, explanation in some phenomena may be error or incomplete, argumentation by explicit evidence help to make a decision to information as well; and h) obtaining, evaluating and communicating information cannot be cut from constructivist science. Literacy seems to important because it make science had voice to connect with people (Norris & Phillips, 2003; Tenopir & King, 2004).

The science classroom environment, that is, students expose in science hours are scaffolding their knowledge and understanding, making positive towards science, engaging them to the lesson. This study need to investigate perception of preservice

teachers in constructivist learning science environment by employing CLES survey with preservice teachers from Thailand and Czech Republic. The research findings help us to prepare professional teachers through the program which constructivist science learning environment should be included and developed.

### **Methodology**

The participants were preservice science teachers from Mahasarakham University (Thailand) and Palacký University in Olomouc (Czech Republic). They were asked for perception about constructivist learning science environment. The study revised the Constructivist Learning Environment Survey (CLES), is being used to study teachers and students perceptions about classroom learning environments. The CLES were adapted from Taylor & Fraser (1991) and Taylor et al. (1997), which the questionnaires are for assessing students' perception of their constructivist-based learning environment in order to reshape teachers' practices. The CLES consists of five six-item scales, namely, *Personal Relevance*, *Uncertainty*, *Critical Voice*, *Shared Control* and *Student Negotiation* and will be used in the study. The five elements of CLES could be explained as below.

*Personal Relevance (PR)* focuses on the connectedness of school where science in students' eyes are based on out-of-school experiences. The everyday use of students' experiences is a meaningful context for the development of students' scientific and mathematical knowledge.

*Uncertainty (UN)* refers to the extent to which opportunities are provided for students to experience scientific knowledge as arising from theory-dependent inquiry involving human experience and values, and as evolving, non-foundational, and culturally and socially determined.

*Critical Voice (CV)* examines the extent to which a social climate has been established where students feel that it is beneficial to question the teacher's pedagogical plans and methods and to express their learning concerns about any issues.

*Shared Control (SC)* is concerned with students being invited to share with the teacher control of the learning environment, including the articulation of learning goals, the design and arrangement of learning activities, and the determination and application of assessment criteria.

*Student Negotiation (SN)* is a scale for assessing the extent to which opportunities exist for students to explain and justify to other students' newly developing ideas, to listen attentively and reflect on the viability of other students' ideas and, subsequently, and to reflect self-critically on the viability of their own ideas.

Data were collected through the academic collaboration between Czech and Thai colleagues. Seventy two Czech and 37 Thai preservice science teachers participated in the constructivist science learning environment study. Data were analyzed by descriptive statistics, mean and standard deviation. Data were shown for presenting how preservice teachers perceived constructivist science learning environ-

ment in their different opinions by indicating into 5 levels of mean for interpreting: highest (4.51-5.00), high (3.51-4.50), medium (2.51-3.50), low (1.51-2.50), and lowest (1.00-1.50). Then data were manipulated and described in terms of level of constructivist science learning environment. ANOVA and independent t-test were used for testing hypothesis.

### Findings

Constructivist science learning environment was investigated through the collaboration of Czech and Thai study. The exploration can be summarized in Table 1 to supporting how constructivist science learning environment occurred in the different contexts.

**Table 1.** Level of perception in the constructivist science learning environment between Czech Republic (n=72) and Thailand (n=37)

| Country        | Elements                 | Mean | SD   | Level of perception |
|----------------|--------------------------|------|------|---------------------|
| Czech Republic | Personal Relevance Scale | 1.51 | 0.81 | Low                 |
|                | Uncertainty              | 2.17 | 1.16 | Low                 |
|                | Critical Voice           | 1.59 | 0.66 | Low                 |
|                | Shared Control           | 3.61 | 0.69 | Medium              |
|                | Student Negotiation      | 2.48 | 0.98 | Low                 |
| Thailand       | Personal Relevance Scale | 3.57 | 0.83 | High                |
|                | Uncertainty              | 3.58 | 0.80 | High                |
|                | Critical Voice           | 3.52 | 0.76 | High                |
|                | Shared Control           | 2.55 | 0.88 | Medium              |
|                | Student Negotiation      | 3.86 | 0.81 | High                |

CLES elements were shown in the Table 1 indicated that two cohort of preservice science teachers from Czech Republic and Thailand had different level of perception in the constructivist science learning environment. Mean score of Czech preservice science teachers had low-medium level. Personal relevance scale, critical voice, uncertainty, and student negotiation were low, but shared control was medium. While Thai preservice science teachers showed their level in medium-high level. Shared control was medium whereas critical voice, personal relevance scale, uncertainty, and student negotiation were high. To test the differences of perception in constructivist science learning environment between national study, independent t-test was employed for testing hypothesis (Table 2).

**Table 2.** Testing the perception differences of preservice science teachers by national comparison

| Country        | Mean | SD   | df | t     | p    |
|----------------|------|------|----|-------|------|
| Czech Republic | 2.27 | 1.16 | 71 | 28.44 | .000 |
| Thailand       | 3.42 | 0.93 | 36 |       |      |

Table 2 indicated that two national preservice teachers had difference perception at .05 level of statistical significance. Thai preservice teachers had higher mean score than those Czech preservice teachers. Mean score was 3.42 of Thai preservice science teachers and 2.27 of Czech preservice science teachers. Then, Data were also analyzed by ANOVA for testing the differences of five elements of constructivist science learning environment (Table 3). Both Czech and Thai preservice science teachers had differences of elements at .05 level of statistical significance.

**Table 3.** Testing the variances of elements

| Country        | Sources of variances | SS       | df   | MS      | F       | p    |
|----------------|----------------------|----------|------|---------|---------|------|
| Czech Republic | Between groups       | 1257.252 | 4    | 314.313 | 407.115 | .000 |
|                | Within groups        | 1663.769 | 2155 | .772    |         |      |
|                | Total                | 2921.020 | 2159 |         |         |      |
| Thailand       | Between groups       | 222.231  | 4    | 55.558  | 83.020  | .000 |
|                | Within groups        | 739.477  | 1105 | .669    |         |      |
|                | Total                | 961.708  | 1109 |         |         |      |

Table 3 showed that six elements of constructivist science learning environment study in both Czech and Thai preservice science teachers were no similarity at .05 level of significantly statistics. To understanding how elements were differenced, Post hoc test was employed for analyzing. Scheffe' procedure was used for correction alpha for pair-wise or simple comparison of means (Table 4).

**Table 4.** Pair-wise elements of CLES ( means no differences)

| Country  | Element |    |    |    |    |
|----------|---------|----|----|----|----|
| Czech    | PR      | CV | UN | SC | SN |
|          |         |    |    |    |    |
| Thailand | PR      | UN | CV | SC | SN |
|          |         |    |    |    |    |

Table 4 showing that in case of Czech preservice teachers had personal relevance and critical voice had no differences, and also critical voice and uncertainty had no differences. While Thai preservice teachers had perception of personal relevance, critical voice and uncertainty had no differences.

### **Discussion**

The classroom environment is may be looked different in the past due to the change in learning environment. In case of Thailand, Chamnanwong & Yuenyong (2014) investigated the science learning environment in Thai primary schools. The study indicated that constructivist science learning environment in different cultures and contexts allowed teachers to applying constructivist teaching into classroom. However, the study is descriptive research which the level of perception of preservice teachers are not reported. While preservice teachers act as key elements to engage constructivist science learning environment into classroom. That is, explorative study in terms of perception should be studied and explain by preliminary investigation. The level of perception constructivist science learning environment in Thai and Czech preservice teachers need to be improved and integrated by instructional strategies. Constructivist science learning environment is a means for facilitating students' learning of science, increasing participation of students to pay attention in the lesson.<sup>1)</sup> The finding relevant to the previous study in teacher preparation program Prachagool et al. (2016) discussed that teacher preparation program in Thailand was managerially controlled in standard of teaching by Teacher Council of Thailand (TCT). University and college that concerned teacher production encourage to the standard and quality which TCT required. This reason seems to relevant level of constructivist science learning environment for Thai preservice science teachers. The preparation program cannot deny how to develop preservice teachers to understand philosophy of education, have managerial skills in classroom, creative and problem thinking in classroom, and classroom research.<sup>2)</sup>

To the element, shared control of constructivist science learning environment, Czech and Thai preservice teachers had medium level of perception, other elements seem to differences. The remark of evidence pointed that personal relevance, uncertainty, critical voice, and student negotiation are differenced, Thai had high level whereas Czech had low level. Data is tested by national comparison also showed that Thai and Czech preservice teachers had differences perception of constructivist science learning environment. However, the exploration is a preliminary survey, constructivist view in difference sociocultural contexts offering by goal of teacher preparation program (Clift & Brady, 2005). Conditions of classroom for open discourse include atmosphere of trust and mutual respect influenced to beliefs (Taylor et.al., 1997). The finding needs to be more exploration how philosophy and practices engage preservice science teachers to enhance construct view in classroom. The constructivist learning seems to be different from those traditional instruction, the

constructivist learning environment science allowed theory that providing framework in the relation of sociocultural, environmental, and pedagogical contexts (Jonassen & Rohrer-Murphy, 1999).

The study found also that Czech and Thai preservice science teachers had different perception, that is, constructivist science learning environment concerned their scientific epistemological beliefs and perceptions of constructivist learning environments. They had epistemological beliefs to constructivist views, they also need to aware epistemological orientation towards scientific knowledge, and designing learning experiences (Tsai, 2000). However, the learning environments which constructivist views lead preservice teachers to positive attitudes. The attitudes toward learning experiences and designs can promote personal relevance, shared control with classroom and negotiate to their learning (Kim et al., 1999). The study was found that personal relevance, critical voice and uncertainty no means of differences. It was not surprised to these elements due to the participants had to be good teachers in the future, the program of teacher preparation encouraged them to classroom management by embedding beliefs and attitude towards learning management (Kim et al., 1999). They also learn to manipulate constructivist environments as well as nature of teaching in science (Beck et al., 2000; Aldridge et al., 2004; Ozkal et.al., 2009).

Constructivist science learning environment study from Czech and Thai reported that the different sociocultural contexts and educational policy to teacher preparation program can make preservice science teachers to explore their perception. This study is a preliminary investigation to bridging the gap of awareness in classroom management and pedagogy which teachers should have and should be professional. Personal relevance, critical voice, and uncertainty of elements showed no differences that make us to understand constructivist view in the teacher preparation program, curriculum and instruction, and nature of science teachers.

## NOTES

1. <http://link.springer.com/article/10.1007/s10763-016-9772-4>
2. <http://teachercodes.iiep.unesco.org/teachercodes/codes/Asia/Thailand.pdf>

## REFERENCES

- Aldridge, J.M., Fraser, B.J. & Sebela, M.P. (2004). Using teacher action research to promote constructivist learning environments in South Africa. *South Afr. J. Educ.*, 24, 245 – 253.
- Beck, J., Czerniak, C.M. & Lumpe, A.T. (2000). An exploratory study of teachers' beliefs regarding the implementation of constructivism in their classrooms. *J. Sci. Teach. Educ.*, 11, 323 – 343.
- Chamnanwong, P. & Yuenyong, C. (2014). Investigation of constructivist science learning environment in Thai primary schools. *Mediterranean J. Soc. Sci.* 5, 592 – 598.
- Clift, R.T. & Brady, P. (2005). Research on methods courses and field experiences (pp. 309 – 424). In: Cochran-Smith, M. & Zeichner, K. (Eds.). *Studying teacher education: the report of the AERA panel on research and teacher education*. Mahwah: Lawrence Erlbaum.
- Daher, W. & Saifi, A.-G. (2016). Democratic practices in a constructivist science classroom. *Int. J. Sci. & Math. Educ.* 1 – 16.
- Duit, R. & Treagust, D.F. (1995). Students' conceptions and constructivist teaching approaches (pp. 46 – 69). In: Fraser, B.J. & Walberg, H.J. (Eds.). *Improving science education*. Chicago: University of Chicago Press.
- Grisham, D.L., Laguardia, A. & Brink, B. (2000). Partners in professionalism: creating a quality field experience for preservice teachers. *Action Teach. Educ.*, 21(4), 27 – 40.
- Gruenewald, D.A. (2003). The best of both worlds: a critical pedagogy of place. *Educ. Researcher*, 32(4), 3 – 12.
- Jonassen, D.H. & Rohrer-Murphy, L. (1999). Activity theory as a framework for designing constructivist learning environments. *Educ. Tech. Res. & Dev.*, 47, 61 – 79.
- Kim, H.B., Fisher, D.L. & Fraser, B. J. (1999). Assessment and investigation of constructivist science learning environments in Korea. *Res. Sci. & Tech. Educ.*, 17, 239 – 249.
- Norris, S.P. & Phillips, L.M. (2003). How literacy in its fundamental sense is central to scientific literacy. *Science Education* 87, 224 – 240.
- Osborne, J. (2011). Science teaching methods: a rationale for practices. *School Sci. Rev.*, 93(343), 93 – 103.
- Ozkal, K., Tekkaya, C., Cakiroglu, J. & Sungur, S. (2009). A conceptual model of relationships among constructivist learning environment perceptions, epistemological beliefs, and learning approaches. *Learn. & Ind. Diff.*, 19, 71 – 79.
- Prachagool, V., Nuangchalerm, P., Subramaniam, G. & Dostál, J. (2016). Pedagogical decision making through the lens of teacher preparation program. *J. Educ. Gifted Young Scientists*, 4, 41 – 52.



- Taylor, P.C. & Fraser, B.J. (1991). CLES: an instrument for assessing constructivist learning environments. *Annual Meeting NARST*, April.
- Taylor, P.C., Fraser, B. J. & Fisher, D.L. (1997). Monitoring constructivist classroom learning environments. *Int. J. Educ. Res.*, 27, 293 – 302.
- Tenopir, C. & King, D.W. (2004). *Communication patterns of engineers*. Hoboken: John Wiley & Sons.
- Tsai, C.-C. (2000). Relationships between student scientific epistemological beliefs and perceptions of constructivist learning environments. *Educ. Res.*, 42, 193 – 205.

✉ **Dr. Prasart Nuangchalerm (corresponding author)**  
Department of Curriculum and Instruction  
Faculty of Education  
Maharakham University, Thailand  
E-mail: prasart.n@msu.ac.th