1. Introduction

Statement of the Problem
A body of research emphasizes that science teachers have difficulties in utilizing computer technology in classroom instruction. Some researchers refer these difficulties to the fact that teacher education programs usually focus on enhancing pre-service teachers’ technology literacy and operational skills (Chien, Chang, Yeh, & Chang 2012; Lubin & Ge, 2012). Research studies suggest that this direction alone does not enhance pre-service teachers’ conceptual understanding of the integration of computer technology in science instruction (Phipps & Ellis, 2002; So & Kim, 2009). In addition to that, pre-service teachers need to construct a technology-based domain of knowledge known as Technological Pedagogical Content Knowledge (TPACK) (Mccory, 2008; Mishra & Koehler, 2006).

Purpose of the Study
The purpose of this study is to investigate the impact of pre-service teachers’ metacognition on the development of their understanding of the integration of computer technology in science classrooms as pertaining to TPACK framework.

Research Questions
1. What changes in understanding of the integration of computer technology in classroom occur as pre-service teachers participate in metacognitive activities?
2. What aspects of metacognitive activities afford opportunities for these changes to occur?
3. How do these changes influence pre-service teachers’ choice of planning and designing a technology-based inquiry lesson plan?

2. TPACK Framework

The components of the TPACK framework (Mishra & Koehler, 2006).

3. Theoretical Framework

Situated Cognitive Learning
Learning is a process of constructing knowledge that occurs in a situated educational context (Wilson & Meyers, 2000). Experiencing technology-based inquiry model can be used as a situated educational context to construct knowledge about technology, pedagogy, and science content.

Metacognition
Reflection-on-action
- Making sense of what have been learned
- Writing critically about one’s learning
- Orienting oneself to design a better learning activity

Reflection-in-action
- Thinking critically about what have been learned
- Writing about one’s thinking and learning
- Adjusting or changing the learning process

4. Teaching Strategy

Role of Cognition
Cognitive activities aim at providing opportunities to develop knowledge and skills of how elementary students learn science concepts, how science is taught through inquiry, and how technology is implemented to enhance teaching and learning.

Role of Metacognition
The metacognitive components are designed to guide learners to think about; and reflect on their cognition before, during, and after their learning tasks. Learners will be guided to monitor and adjust their course of learning in order to achieve their desired outcomes.

Role of Learners
- Learning science concepts, and experiencing how to teach science via guided-inquiry approach
- Discussing the pedagogical necessity as a rational to implement computer technology in classroom
- Analyzing various situations in which technology can be utilized to resolve content complexity;
- Identifying the dynamic interplay between technology, pedagogy, and science content

Role of Teacher
- Implementing learning cycle as a situated inquiry model for teaching science with technology
- Providing various strategies or scaffolding techniques to guide learners to accomplish their cognitive and metacognitive tasks
- Assessing pre-service teachers learning

5. Methodology

Participants
Participants will be conveniently selected in a quasi-experimental design, from the Teacher Education program at the University of Ottawa, and will be randomly assigned to two groups: Experiencing Inquiry Model (EIM) and Metacognitive Scaffolding (MS). The participants are expected to represent those who are enrolled in teacher preparation programs and intending to teach science in intermediate/elementary division.

Data Analysis
A 2-way factorial design will be conducted on the mean differences between the pre-service teachers’ pre- and post-test scores, as well as the pre- and post-concept maps in a 2 Teaching Method × 2 Time split-plot (ANOVA). A t-test will be conducted between the participants’ scores in designing technology-based lesson plans.

References


