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Title of Ph.D. Thesis: DEVELOPMENT OF A MODULE BASED ON TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE (TPACK) MODEL FOR PRE-SERVICE SCIENCE TEACHERS AND EVALUATION OF ITS EFFECTIVENESS

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ABSTRACT

Today's era is a technological era, where the immense growth of technology has been seen. There is not a single human domain remained uncovered from its effect. Due to technological growth and advancement in research, the knowledge is expanding day-to-day. The curious nature of the human mind always tries to uncover the phenomenon of the world. Therefore, it is a very challenging task to prepare teachers who can support 21st century learners' needs to construct their knowledge. Moreover, the science is another specific discipline covered expanding body of knowledge and process. Science is a knowledge as well as the process. The process approach of science is crucial for learners. Many national standards of science have priority for using the technology in engaging students in scientific inquiry, reasoning ability, critical thinking and problem-solving activities (ISTE, 2008). The classroom environment should be such as to provoke questioning, reasoning, scientific inquiry, discussions, debates and enhances students' Metacognitive skills (NFG on science, 2005). A part of this promise is that the technology makes it easier for students to design science experiments, interact with simulated phenomena, and receive feedback to refine their scientific understanding.

From the above concern, the investigator developed a module based on the TPACK model using the 5Es inquiry model cycle, investigation activities in science teaching and learning. To design the TPACK module, the investigator has selected three topics of science, i.e. cell membrane diffusion, acid-base test and construction of electric circuits. To design of inquiry investigation activities in science, the investigator uses 5Es instructional cycle i.e., engagement, exploration, explanation, elaboration, and

evaluation by using open source science resources (Phetcolorado.com, onlinelabs.com, Vernier.com) simulations. After the intervention of module, the preservice science teachers develop insight for effective ICT integration in their teaching-learning processes and followed the process of ICT module in their lesson plan designing for effective ICT integration in teaching and learning of science. The “Technology Integration Assessment Rubric” (TIAR) was used for analysis of the preservice science teachers’ Lesson plan. Moreover, the pretest and posttest of perceived TPACK development are measured. By using, the “Wilcoxon Signed Rank Test” the significant mean difference of pretest posttest are analyzed. In addition, the magnitude of effect size is also measured by using the Cohen’s (d) benchmark. The results reveal that TPACK module has a significant role in enhancing the preservice teachers perceived TPACK, which is useful for ICT integrated science teaching and learning. Except for CK and TPK, the others TK, PK, TCK, PCK and TPACK constructs showed a significant change in posttest results. The experience of ICT module cannot determine to change in CK because the module does not focus on preservice teachers’ Content Knowledge (CK). However, an insignificant change occurs in TPK is questionable. It might be possible due to the short duration of intervention periods.

The perceived effectiveness of 5Es inquiry model activities analysis result also shows that the ICT module very purposefully and pedagogically sounded. The majority of respondents report that module is helpful to design of teaching and learning activities with effective technology integration in the specific content of science.

The findings indicate when ICT module taught to preservice science teachers its emphasized on uses of appropriate technological affordances i.e. simulations, animations, useful website links and group discussion forum. By following the above, the preservice science teachers develop insight to understand the affordances and effective use of ICT tools in the subject-specific context. Therefore, teacher educator used such consideration for preservice teachers professional development.

The findings indicate when taught the ICT module the preservice science teachers’ TK, PK, TCK, PCK and TPACK enhanced it shows effective technology integration should address meaningful science with suitable pedagogical strategies in teaching learning process. Therefore, teacher educators should consider the above.