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Examining the development of topic specific pedagogical content knowledge in stoichiometry in pre-service teachers

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Abstract

Over the past three years, National Senior Certificate diagnostic reports reported that learner performance in key chemistry topics remains an aspect for concern. In these reports, poor understanding of stoichiometry is identified as an underlying factor. On the other hand, the status of mathematics and science teaching has been under critique by several education researchers, pointing to poor teacher training in the subjects. One possible way to respond to the challenge in science education is to introduce and emphasize the development of Topic Specific Pedagogical Content Knowledge (TSPCK) as the professional knowledge for teaching science topics in Initial Teacher Education (ITE) programme. TSPCK is renowned for enabling teachers to pedagogically transform difficult content of specific science topics into forms best understandable by learners. This study examined the impact on the quality of TSPCK following an intervention that explicitly targeted the development of the competence to transform content knowledge using stoichiometry as a topic of learning. This examination happened as teacher plan to teach the topic.

The study followed a Mixed Method research design and a case study as a research strategy. It was located in the methodology class of physical science IV. The participants were 10 pre-service teachers who were in their final year of Bachelor study in education (B. Ed). They were bound by the requirements of the course and their common choice of physical science as their major subject. These pre-service teachers were exposed to a TSPCK based intervention that explicitly targeted the development of TSPCK component interaction. More evidence of component interactions was comprehended as developing quality of TSPCK. Quantitative data was collected as a set of pre- and post-intervention TSPCK tests using existing, specially designed tools that were developed and validated in a separate study. Five (5) of the then pre-service were followed a year later after the intervention to measure the quality of TSPCK in the topic of intervention in order to determine the extent of retention of the quality of TSPCK since the intervention. Qualitative data was collected through face to face interviews to confirm observed patterns of retention.

The findings in this study indicated that pre-service teachers experienced a visible improvement in the quality of their TSPCK in stoichiometry as a direct result of the intervention. Pre-service teachers showed more evidence of component interactions

post the intervention. The results further indicated that pre-service teachers experienced the components of TSPCK to have different levels of difficulty when using them to transform the content in stoichiometry during planning. The component of “conceptual teaching strategies” was found to be the most difficult. A year later, the quality of TSPCK in planning to teach the topic of the intervention was found to have been retained by the then pre-service teachers. Recommendations about the implementation of TSPCK in core topics in ITE are made. Firstly, for initial teacher education, it is recommended that courses such as methodology for teaching chemistry be structured as TSPCK based intervention.

Secondly, more work need to be done in the examination of retention span of TSPCK. Thus, similar studies must be conducted in an effort to increase empirical evidence about the extent at which TSPCK is retained by beginning teachers.