

## SYM-13

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## Learning Study: How a Networked Learning Community Deepens Chemistry Teachers' Understanding of Students' Difficulties in Learning

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There is common understanding among many academics that chemistry is a difficult subject for students to learn, and for teachers to teach (see Sirhan, 2007). According to Johnstone (2000), the difficulties may lie in how students learn as well as the intrinsic nature of the subject. Understanding these aspects is critically important for effective teaching to take place and forms a major part of the pedagogical content knowledge (PCK) for chemistry teachers (De Jong, van Driel, Verloop, 2004; Rollnick et al, 2008; Chittleborough, 2014). The development of PCK is an important goal to focus on in professional development programs for teachers (van Driel and Berry, 2012). Cheng (2009) suggested Learning Communities as an effective way of achieving such a goal. Learning communities with such a goal generally allow teachers to collaboratively investigate their instructional practices and check their own pedagogical assumptions (Hattie, 2009). When the emphases of such inquiry are on both subject content and how students learn the content, it may result in greater teaching competencies, which eventually lead to improvements in student learning (Desimone et al., 2002; Holmqvist, 2011). With these objectives in mind, teachers in Singapore are encouraged to form Networked Learning Communities (NLCs). Our NLC comprises fifteen teachers and one Master Teacher from the Academy of Singapore Teachers as the Knowledgeable Other. The 15 chemistry teachers have different number of years of teaching experience and are from seven secondary schools. For the past two years, the NLC's collaborative inquiry project was on the topic: the preparation of chemical salts. Members identified the topic because it is challenging to teach and noticed that students seemed to have difficulties deciding on suitable reactants to prepare different types of chemical salts. The initial observation of students' common difficulties led the group to hypothesize that their students probably have problems categorizing different chemical salts according to their solubility in water. Learning Study was used to investigate the hypothesis and to develop teaching strategies that could address our students' problems. The Variation Theory framework that underpins Learning Study offers two important advantages. First, it focused us on our students' prior knowledge about the reactants to form a salt (the object of learning) as well as the critical aspects that could be important for their understanding but not normally discerned by them. Second, we had to look at how we could deploy our teaching strategies for the topic in order for our students to focus on the critical aspects of preparing a salt. In this symposium, the team shall first elaborate on the idea of

the Chemistry NLC. The presentation will center on the specific objectives of NLC, how learning is organised through a blended approach as well as the framework in which the collaborative project was carried out across different schools. The second presentation discusses Learning Study in the context of the project. The team shall share the results of our pre- and post-tests and findings from interviews conducted in the different schools to determine the critical aspects of the object of learning. The team would also share the research lesson and show how the critical aspects were linked to the object of learning and how the different strategies in a lesson designed using patterns of variation might impact students' understanding. In the final presentation, the team shall share how teachers from the different schools have worked collaboratively in the NLC and leveraged each other's PCK to create new knowledge and understanding, and ultimately helped in enhancing student learning. The team shall also present further ideas that it is working on based on the outcomes of the project.