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A Multidisciplinary and Comprehensive Chemistry Teaching/Learning for Next Generation

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Abstract

It is recognized that the successful promotion of STEM education is continuous subject for realizing the sustainable development of the world with the aid of scientific and engineering innovations. For promoting STEM education, science education involving chemistry education should play an important role because of its multidimensional objects. When the educational objects, involving the trainings and acquisitions of scientific concepts, knowledge, methodologies, skills, logical thinking, science ethics, and so on, were sufficiently achieved as the results of highly motivated student inquiries, the teaching/learning activities in science education can be the core for linking different STEM subjects and promoting the overall STEM education. For chemistry education, many distinguished materials and phenomena applicable to introduce different chemical topics at different learning stages are available in our neighborhood. Using those instruction materials, well-organized inquiry activities for studying chemistry can be designed with different types of scientific inquiry processes. For the success of chemistry education, systematic organization of the multiplicities of the instruction materials and pedagogical designs in chemistry learning programs and curriculums appears to be one of the keys.

In this talk, a possible strategy for realizing such a multidisciplinary and comprehensive chemistry teaching/learning in K-12 level is discussed by reviewing our challenges of research based educational practices in STEM-focused schools. First, the basis for developing the next generation chemistry teaching/learning is considered on the basis of the present status and issues of chemistry education. A possible curriculum design is then proposed with an emphasis of the requirement of storylines of chemistry learning for students. A series of learning programs with different styles of inquiry-based laboratory exercises applied at different learning stages and situations construct the storyline, which closely correlates everyday chemistry learning based on content-based learning and periodically introduced inquiry-based learning. Instruction materials utilized in the learning programs can be found in elsewhere. The learning programs using household materials [1,2], minerals [3], and thermochemical phenomena [4-9] are introduced by describing the multiple faces of these instruction materials and pedagogical logics and by reviewing our educational practice in schools. The multifaceted feature of the instruction materials links length and breadth of the different learning topics in chemistry, the different subjects in science education, and further the different STEM subjects. At the end, ability being required for chemistry teachers for promoting the ideal chemistry education is discussed by introducing the know-how of pre-service and in-service teacher trainings accumulated in our Department of Science Education, Graduate School of Education, Hiroshima University.

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