

Part IV

Curriculum and Assessment in Chemistry Education

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The alignment among curriculum standards, instruction, assessment, and evaluation plays an important role in educational reform. The outcomes from assessment and evaluation shape effective and constructive instructional materials and programs from which teacher professional development should be implemented. Six chapters are included in this section. First, Ma, Fulmer, Liang, Chen, Li, and Li adopted Porter's method of analysis of textbooks to investigate the alignment of chemistry curriculum standards of junior high school and 9th graders' exit examinations in three cities in China. They found that as a result of a shift of curriculum standards from merely content-oriented to higher-order cognitive competence, a misalignment between standards and assessment was found. Second, Lin and Chiu used an alternative assessment format, the two-tier diagnostic instrument, to investigate secondary school students' conceptions of chemical equilibrium and acid/base. The results revealed that even high school students still did not possess a well-developed understanding of chemical equilibrium concepts and ionization. Misconceptions related to macroscopic, microscopic, and symbolic representation by the students were also found. These findings revealed that the students might be able to memorize factual information but were not able to provide high-quality explanations for scientific phenomena. The third chapter, by Burns and Frank, proposes an alternative assessment, learning logs, to evaluate the effectiveness of a college chemistry course. They found that, based upon qualitative analysis from learning logs, the instructor was able to reflect and improve his teaching in chemistry. Lay and Khoo investigated how the learning environment in schools influences students' learning in Malaysia. The results revealed that there is a significant difference in the perceptions of the tertiary chemistry learning environment between primary and secondary school pre-service chemistry teachers. The questionnaire they developed could be used

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for teacher professional development. The female students perceived their tertiary chemistry learning environment more favorably compared with male students, even though it did not reach the significance level. The fifth chapter, by Yang, Hsu, and Wang, assessed freshmen's chemistry competence at technology colleges. The results showed that the students had high motivation to pursue their advanced studies but were lacking in understanding regarding some chemistry concepts, namely, structures of atoms, molecules, and ions, which are microscopic concepts. This result is consistent with the research in the literature. Finally, Chen and Chiu investigated how chemistry teachers changed their views of cognitive apprenticeship for chemistry laboratory via working with science educators. They found that with a longitudinal collaboration between school teachers and researchers, conceptions of ideal teaching style should involve a cognitive apprenticeship approach. Therefore, perceptions of instructional strategies were changed in a constructive manner.