Chapter 17
Using S–P Chart and Bloom Taxonomy to Develop Intelligent Formative Assessment Tools

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ABSTRACT

E-learning provides a convenient and efficient way for learning. Formative assessment not only guides student in instruction and learning, diagnose skill or knowledge gaps, but also measures progress and evaluation. An efficient and convenient e-learning formative assessment system is the key character for e-learning. However, most e-learning systems didn’t provide methods for assessing learners’ abilities but true-score mode. In this article, Sato’s Student-Problem Chart (SP Chart) is applied to integrate with our proposed on-line assessment system. Teachers are able to analyze each learner easily and efficiently. In addition, the Bloom Taxonomy of Educational Objective supports each item in our assessment management system during the authoring time. In our proposed system, it provides groups of function for student, teacher, and system administrator. According to the SP Chart analysis and Bloom taxonomy of items, we can divide all items into four types, and students into six types. With these types of diagnosis analysis chart, teacher can modify or delete the items which are not proper. With diagnosis analysis chart of students, teachers can realize learners’ learning situation easily and efficiently.

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INTRODUCTION

Assessment is the process to measure and analyze students’ performance and learning skill. Assessment is also able to give feedback both to the teacher and student in how to improve their future performance. Assessment can be denoted as the central part in learning and mental development. Robert Glaser (1962) first constructed an “Instructional System” which is composed of instructional goals, entering behavior, instructional procedures, and performance assessments. Instructors set instructional goals and apply appropriate teaching and learning activities for students. With the result and analysis of assessment, instructors can revise the related teaching strategies and change the learning materials to help the students to overcome the obstacles. Many studies concentrate on providing assessment system to test and to verify their point of views. Olly Gotel, Christelle Scharff and Andrew Wildenberg (2008) also combined with innovative pedagogical approach, which is based on students contributing programming problems to an open source web-based system that is used for student practice and instructor assessment of assignments. This requires students to construct comprehensive unit tests that can assure both the usability and accuracy of their work prior to deployment. Wang (2007) demonstrated a well designed on-line assessment system and strategy makes students achieve better learning effectiveness.

Ebel and Frisbie (1991) observed that the terms “formative” were introduced by Scriven (1967) to describe the various roles of evaluation in curriculum development and instruction. Formative assessment is one of the assessment methods. It monitors the instructional process and determines whether learning is taking place as planned. Formative assessment assists learner learning, diagnoses learning knowledge gap, evaluates learning performance and measures teaching progress. Teachers could modify the teaching techniques and tutoring strategies, and determine what knowledge concept needs more teaching or more exercises. After a period of time, teachers can collect the assessment result to make some adjustments for future performance. Formative assessment not only guides student instruction and learning, diagnoses skill or knowledge gaps, but also measures progress and evaluate instruction. Teachers apply formative assessment to decide what concepts require more teaching and what teaching techniques require modification. Over time, educators use results to evaluate instruction strategies, curriculum and teachers, and make adjustments for better student performance.

The learning cycle used in these lesson plans follows Bybee’s (1997) five steps of Engagement, Exploration, Explanation, Elaboration, and Evaluation. As in any cycle, there’s really no end to the process. After the elaboration ends, the engagement of the next learning cycle begins. Evaluation is not the last step. Evaluation occurs in all four parts of the learning cycle. The description of each part of the learning cycle draws extensively from our previous works (Lin, Nigel H., Chang W.C., Shih T. K., & Keh H.C., 2005; Chang W.C., Hsu H.H., Shih T. K., & Wang C.C., 2005).

Black and William (1996; 1998) define assessment broadly to include all activities that teachers and students undertake to get information that can be used diagnostically to alter teaching and learning. Under this definition, assessment encompasses teacher observation, classroom discussion, and analysis of student work, including homework and tests. Assessments becomes formative when the information is used to adapt teaching and learning to meet student needs. Assessment focuses on the gap between students performance and instruction goal. Formative assessment focused on the information gathered must be used to adapt the teaching or the learning to meet the needs of the learner. However, forma-