Chapter 2.20
An Adaptive Feedback Framework to Support Reflection, Guiding, and Tutoring

Evangelia Gouli
University of Athens, Greece

Agoritsa Gogoulou
University of Athens, Greece

Kyparisia A. Papanikolaou
University of Athens, Greece

Maria Grigoriadou
University of Athens, Greece

ABSTRACT

In this chapter, an adaptive feedback framework (AFF) is proposed for the provision of personalized feedback accommodating learners' individual characteristics and needs in the context of computer-based learning environments. Multiple informative, tutoring, and reflective feedback components (ITRFC) are incorporated into the framework, aiming to stimulate learners to reflect on their beliefs, to guide and tutor them towards the achievement of specific learning outcomes and to inform them about their performance. The proposed framework adopts a scheme for the categorization of learners' answer, introduces a multi-layer structure and a stepwise presentation of the ITRFC and supports adaptation of the provided feedback both in the dimensions of adaptivity and adaptability. The adaptivity of the AFF is based on the gradual provision of the ITRFC and on the adaptive presentation of the ITRFC according to the learner's knowledge

level, preferences and interaction behaviour. The adaptability of the AFF enables learners to have control over the feedback presentation in order to guide the adaptive dimension of the framework. In the context of the Web-based concept map assessment tool referred to as COMPASS, the proposed framework has been adopted for the provision of personalized feedback in concept mapping tasks. A preliminary evaluation of the framework in the context of COMPASS showed that the AFF led the majority of the learners in reviewing their maps, reconsidering their beliefs and accomplishing successfully the underlying concept mapping task.

INTRODUCTION

Feedback is considered as a key aspect of learning and instruction (Mory, 1996). Bangert-Drowns, Kulik, Kulik, and Morgan (1991) emphasize that "… any theory that depicts learning as a process of mutual influence between learners and their environments must involve feedback implicitly or explicitly because without feedback, mutual influence is by definition impossible. Hence, the feedback construct appears often as an essential element of theories of learning and instruction". Effective feedback aims to (i) assist learners in identifying their false beliefs, becoming aware of their misconceptions and inadequacies, and reconstructing their knowledge, (ii) help learners to determine performance expectations, identify what they have already learned and what they are able to do, and judge their personal learning progress, and (iii) support learners towards the achievement of the underlying learning goals (Mason & Bruning, 2001; Mory, 1996). Thus, feedback should guide and tutor learners as well as stimulate and cultivate processes like self-explanation, self-regulation, and self-evaluation, which require reflection (Chi, de Leeuw, Chiu, & Lavancher, 1994; Vosniadou, 2001). Moreover, feedback should be aligned, as much as possible, to each individual learner's characteristics, since individuals differ in their general skills, aptitudes, and preferences for processing information, constructing meaning from it and/or applying it to new situations (Jonassen & Grabowski, 1993).

Characteristics that influence the effectiveness of feedback concern the type of feedback, the amount of the provided information as well as the adaptation to learners' individual differences. Various types of feedback have been proposed and investigated in literature (see reviews by Bangert-Drowns et al., 1991; Mason & Bruning, 2001; Mory, 1996), providing different levels of verification and elaboration. The level of verification and elaboration determines the amount of the provided information. Moreover, many researchers introduce the notions of adaptive feedback (i.e., different learners receive different information) and adaptable feedback (i.e., learners have the possibility to choose the feedback that suits their needs or preferences) (Jackson, Krajcik, & Soloway, 1998; Sales, 1993) in an attempt to compensate for the weakness of generic feedback to "communicate" with learners and to provide personalized information.

Empirical studies, investigating whether the type and the amount of feedback are related to learners' individual differences, draw implications for the degree of success or failure experienced by learners. Hedberg and McNamara (1985) found that field dependent (FD) learners had fewer errors when their errors were explained and they were given strategies for correcting them, whereas field independent (FI) learners had fewer errors when only the correctness/incorrectness of their answer was provided. In the study of Arroyo, Beck, Beal, Wing, and Woolf (2001), it was revealed that boys benefit more from explanations that are fast to check and go through, while girls devote their time to go through any kind of explanation and do better with hints that are highly structured and interactive.

As far as the adaptation of feedback to learners' individual differences is concerned, little