USING ARCS MODEL TO PROMOTE 11TH GRADERS’ MOTIVATION AND ACHIEVEMENT IN LEARNING ABOUT ACIDS AND BASES

ABSTRACT. The purposes of this study are: to apply the ARCS model in designing an acid and bases unit, and to assess a single class of 11th graders for motivation and achievement outcomes before and after ARCS instruction. Four essential strategies for designing motivation instruction in the ARCS model were: Attention, Relevance, Confidence, and Satisfaction. We used the ARCS model in designing a 10-hour acids and bases lesson for one class of 11th graders with low interest and motivation in chemistry learning. Both the Students’ Motivation toward Science Learning questionnaire (SMTSL) (Tuan, Chin & Shieh, in press) and a teacher-designed achievement test were implemented before and after instruction. In addition, students’ self-reporting on time engagement in learning before and during the instruction was also collected. The results of the study indicated that both students’ motivation and achievement in the acids and bases unit increased significantly ($p < 0.05$) after the ARCS instruction. Students’ time engagement during the ARCS lessons had increased from before. Findings of the study showed that using the ARCS model to teach acids and bases unit could improve low motivated students’ level of motivation and achievement. The implications for chemistry teaching will be discussed in the paper.

KEY WORDS: ARCS instruction, chemistry learning, chemistry teaching, student’s motivation

To design effective instruction, teachers must take students’ learning motivation into consideration, because pupils learn only if they want to learn (Fairbrother, 2000). Fairbrother (2000) indicated that student motivation is the single most important factor in raising standards of a national curriculum. But the educational reforms of the past years have concentrated more on both changing the organization and structure of the educational system and on attempting to improve the quality of teaching and teaching materials. Few efforts have addressed helping students promote their motivation for learning. Motivation refers to a student’s willingness, need, desire and compulsion to participate in learning, and to be successful in the learning process. Addressing students’ motivation can help students be involved in both classroom activities and concept understanding (Bomia, Beluzo, Demeester, Elander, Johnson & Sheldon, 1997). The researchers (Barlia & Beeth, 1999; Pintrich, Marx & Boyle, 1993) pointed out that students’...
motivation is an important factor that can lead to raising or lowering the status of students’ level of concepts.

Zoller (1999) stated that traditional chemistry teaching relies heavily on lecturing. In the lecture environment, students use a passive approach in learning chemistry. Gabel (1999) surmised that the primary barrier in understanding chemistry is that chemistry instruction occurs predominantly on the abstract and symbolic level. It is hard to increase students’ motivation only by conveying the threefold sub-micro, macro, and symbolic dimensions of chemistry with students. Learning is not just to understand and as researchers (Barlia & Beeth, 1999; Fairbrother, 2000) have mentioned, there are a numbers of factors that affect a pupil’s ability to respond and learn from classroom teaching. The motivational aspect of learning can not only assist pupil’s learning, but can also provide them with a set of skills which will benefit their lifelong learning (Fairbrother, 2000). Thus, in order to help students learn chemistry, one direction might be to promote instruction based on students’ motivation rather than their cognition.

Although traditional teaching also emphasizes increasing students’ motivation initially, it is more important to sustain learning motivation during the teaching process. The teaching process should be seen as a motivational process and cannot be looked at in isolation (Visser, Plomp & Kuiper, 1999). Recently, research on motivation has focused on the identification of effective techniques for enhancing instructional design and improving classroom management (Small, 1997). Among the various models, the ARCS model (Keller, 1983) has been considered a systematic and easy-to-apply model for designing motivational instruction (Shellnut, Knowlton & Savage, 1999; Small, 1997; Song & Keller, 1999).

The purposes of the study are: applying ARCS the model to designing an acids and bases unit, and assessing the students’ motivation and achievement after learning the acid and bases unit.

**Literature Review**

From high school to the university chemistry curriculum, the topic of acids, bases and pH is considered a challenging topic for students to understand (Nakhleh & Krajcik, 1994; Zoller, 1990). This, in turn, has led to the creation of several different teaching models to address the concepts of acids and bases, such as: including various learning technologies (Nakhleh & Krajcik, 1994), integrating multiple teaching methods (Francisco, Nicoll & Trautmann, 1998), and emphasizing epistemological reasoning (Erduran, 1999). Students’ motivation is also an important component of learning