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## Use of the ARCS model in education: A literature review

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## ABSTRACT

This article reviews empirical research on applying the Attention, Relevance, Confidence, and Satisfaction (ARCS) model to real educational settings, including computer-based learning approaches. This review focuses on three aspects: (1) how the ARCS model was applied to what specific educational settings; (2) what research methods were used; and (3) what outcomes were reported in these studies. Our findings indicate that the ARCS model was applied to a variety of countries and educational settings. The course component(s) in which the ARCS model was incorporated included single course component (e.g. course email), multiple course components, and other programs (e.g. specific software or game). Quantitative methods were used more than qualitative and mixed methods in these reviewed studies. Four major research outcomes were found in regard to participants' affective domain, cognitive domain, learning behaviors, and psychological traits. We also summarized the studies in this review and provided future research directions. The latter includes applications of design-based research to educational problems that the ARCS model might address, especially in the context of computer-based learning.

## 1. Introduction

Motivation is an important concept in human behaviors, and it plays a key role in student learning and in how educators can help students learn better (Pintrich, 2003). Motivation is tied closely to student learning achievement and is often considered one of the main factors that keep students learning (Paas, Tuovinen, Merriënboer, van and Darabi, 2005). Students with different levels of motivation tend to behave differently in learning. For example, students with high motivation showed more exploratory learning behaviors (Martens, Gulikers, & Bastiaens, 2004). Besides the fact that motivation is connected with learning achievement, the effects of motivation on students' positive emotional experience during learning is also a critical component (Schiefele, 1991).

One important question that motivational research should answer is how to motivate students in learning (Weiner, 1990). Motivational design, seeking to answer this question, is defined as “the process of arranging resources and procedures to bring about changes in people's motivation” (Keller, 2010, p. 22). One commonly used motivational design model is the attention, relevance, confidence, and satisfaction (ARCS) model. The ARCS model is rooted in a theoretical foundation: the expectancy-value theory (Keller, 1987a). The model states that, in order to motivate students, the instructor or instructional materials need to (1) catch and sustain students' attention; (2) state why the students need to learn the content; (3) make students believe that they are able to succeed if they exert effort; and (4) help students feel a sense of reward and pride (Keller, 1987a). The ARCS model utilizes a systematic process which can be specified into four steps: define, design, develop, and evaluate (Keller, 1987a). Furthermore, many of the other motivational literature's recommended strategies to improve students' motivation fall under the four components of the ARCS model (Hodges, 2004).

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The ARCS model was well-developed and validated more than 30 years ago (Keller, 1987a), and thus it is not surprising that the model has been used in widely different contexts (e.g. face-to-face classes as well as online environments) by researchers from many different countries. Motivational materials and strategies designed from the model vary (e.g. embedding strategies into videos or instructional texts), and the results of the study are not always consistent (e.g. whether students' motivations are increased). In addition, the student body in terms of their demographics, cultural beliefs and learning strategies as well the learning technologies differ significantly from when the ARCS model was first created. Thus, some ARCS strategies may not be effective for certain student population or in a particular learning environment. From all the points discussed above, a comprehensive review of empirical studies of applying the ARCS model is much needed to build a holistic view of how the model is applied to educational settings and what the outcomes are. Such is the purpose of this review which has research questions: (1) what are the educational settings to which the ARCS model has been applied? (2) what research designs have been used in past empirical studies? and (3) what are the reported outcomes after applying the ARCS model?

The structure of this article is as follows. Section 2 introduces the search and selection process as well as analysis method. Section 3 presents the results and discussions of the research questions. Section 4 concludes the article and provides future research directions.

## 2. Method

### 2.1. Selection criteria

Based on the purposes introduced in section 1, the following selection criteria were used to select relevant articles:

1. The articles must be published in peer-reviewed journals in English. Conference proceedings and book chapters are excluded from this review.
2. The studies must be conducted in actual educational settings, which can include face-to-face instruction, blended courses, or online courses, and not limited to learners of certain ages.
3. The studies must apply the ARCS model in designing instruction and/or instructional materials. Studies that used only surveys to measure the four components of the ARCS or studies only examined course materials for ARCS components without designing ARCS strategies are excluded from the review.
4. The articles must report empirical data, analyze the data and interpret the results. Conceptual papers are excluded from the review.

### 2.2. Search and selection procedures

The electronic databases searched in this review included Academic Search Complete (ASC), Education Resources Information Center (ERIC) and Education Full Text (EFT). The key words used to search for relevant articles were (1) *ARCS model*, (2) *ARCS*, (3) *motivational design*, (4) *motivation design*, and (5) *attention, relevance, confidence, satisfaction*. These searches uncovered a total of 99, 1128, 59, 41, and 66 peer-reviewed journal articles published in English, respectively. After a careful examination of these articles, 23 met the four criteria presented above. Google Scholar was then used to identify additional articles, which yielded 6000 + results, an examination of the first 10 pages produced four additional articles. A scan of the articles' references produced no additional articles. As of February 22, 2018, a total of 27 articles were included in the final review.

### 2.3. Data analysis

The basic unit of analysis was each individual article. Since our research questions are descriptive in nature and most articles did not report enough statistical results for a meta-analysis, content analysis was used in this review. We used the summative approach of content analysis in that we compared and contrasted all the articles based on the three research questions (Hsieh & Shannon, 2005). The analysis was achieved by four phases of analysis. In each phase, the first author coded the articles, classified them, and created summary charts. Then the second author reviewed the summary charts and discussed details with the first author. Both of them revised the chart and synthesized the results, and finally reported the results in different sections.

The first phase involved categorizing the educational contexts and how the ARCS model was applied in these contexts. In this phase, a summary chart was created with information of study contexts and the ARCS strategies implemented. The results were reported in section 3.1. In the second and third phases, we analyzed the research design and research outcomes respectively. Relevant variables measurement was also presented. The results were reported in section 3.2. The research outcomes were categorized into areas (i.e., cognitive domain, affective domain, learner behaviors, and psychological traits) and into whether the study found significant differences in the variables they measured. The results were included in section 3.3. In the fourth phase, we synthesized the results from the first three phases, analyzed them critically with advantages and problematic areas, recognized the study limitations and provided future directions. This part was outlined in section 4.

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