



Creating an integrative assessment system for green schools in Iran



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ABSTRACT

Many assessment systems for green schools exist to guide schools toward environmentally responsible choices. To identify a nation's green schools, an assessment system must be developed for their selection. When green school standards are lacking, measures must be created, including an information model enabling decision makers to recognize these schools. The aim of this study is to create an integrative system for assessing green schools in Iran and to develop scientific support in school selection, in order to avoid hasty choices and to respect the selection of these schools. In this study, by using fuzzy multi-criteria decision making methods, the criteria of green schools have been gauged across 6 criteria and 15 sub-criteria, using a consistent testing methodology. This renders paired comparisons more reliable. Ghazanfari and Mikhailov methods were utilized. To evaluate practical applications, the developed criteria were used in assessing 5 selected green schools in Tehran. The integrative assessment system with proposed criteria showed that green schools 5, 3, 4, 1 and 2, respectively, have earned first to fifth rank in terms of proposed criteria for green schools. Establishing an assessment system and its application through methodology limits incorrect choices, removes the green schools' selection from the domain of non-specialists, restrains subjective methods, and puts selection into the hands of professionals and specialists with scientific support. Due to the need to communicate effectively, to engage experts and to address the complexity involved in the assessment system for green schools, the proposed integrative system was designed to assess green schools.

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1. Introduction

Current environmental problems are rooted in the lack of proper awareness and cultural weakness regarding the relationship between man and nature. A wide range of environmental education opportunities have been incorporated in the curricula in schools worldwide (Hens et al., 2010). Effective school programs should not only help students to progress the knowledge, attitudes and skills necessary for responsible environmental behavior, but also have the potential to spread awareness of the concept (Çinçera and Krajhanzl, 2013; Zhao et al., 2015).

Under such circumstances, environmental issues have only belatedly been recognized in school activities worldwide (Hens et al., 2010). In 1992, twenty years after the Stockholm Conference, the Rio Conference was held in Rio de Janeiro, Brazil. The result was the preparation of a charter entitled Agenda 21. According to Agenda 21, "(Principle 22) ... local communities have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development" (UN, 1993). Furthermore, Chapter 36.3 of Agenda 21 states, "Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues" (UN, 1993).

In response to this statement, green school efforts have been initiated worldwide. For instance, the International Eco-Schools program was started by the International Foundation for

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Environmental Education (FEE) in 1994 (FEE, 2015). The program offers a flexible approach for schools to implement an Environmental Management System (EMS), the so-called 7 steps, based on EMAS/ISO 14001 standards (Tönük and Kayihan, 2013). The world system refers to the integrated aspects of an organization (Hens et al., 2010). Green school, also known as Eco-Schools, have a range of beneficiaries, including managers, teachers, families, students, and school personnel, and provide training with a focus on students, particularly where they adopt an integrative system for sustainable development that embraces activity, curriculum, building, and research. A similar study was conducted by Hens et al. (2010). With the aid of universities, EMSs were developed and implemented in 39 primary schools in northern Gauteng and southern Limpopo provinces, South Africa. Between 2006 and 2008, the supporting universities monitored the implementation process to evaluate the progress the schools made in environmental management and performance. The monitoring results exposed the main parameters, which led to development of the environmental performance of the schools. These results can be used to improve the process of EMS implementation in the future. Lozano et al. (2013) analyzed the texts of 11 declarations, charters, and partnerships developed for higher education institutions, which can be considered to represent university leaders' intentions to improve the effectiveness of Education for Sustainable Development. Sammalisto and Brorson (2008) at the University of Gävle, Sweden, indicated that training is a key factor during implementation of EMS within a university campus.

Similar activities have also taken place in Iran. For instance, in 2009, the headquarters of the Tehran Municipality's Environment and Sustainable Development, in collaboration with a nongovernmental organization, the World Green Star, led environmental education projects in green schools. Finally, after several revisions in FEE's Foundation Council, on 31 December 2010, Iran was selected as the 69th member of the Foundation (Shobeiri et al., 2014). Now, in Iran, green schools are those that complete the verification process with the World Green Star organization, and receive their licenses.

Today, the green school assessment system in Iran tended on a single target, such as furthering the development of green schools through networking, and commending those schools that were willingly contributing to environmental education by citing them as green schools. Such a lack of integrated efforts takes a serious toll on their commitment to further green their schools and may result in ineffectual and inefficient implementation of their planned targets. Therefore, it is necessary to create an integrative assessment system for green schools in Iran.

The present assessment system for green schools in Iran raises several questions, which should be addressed in determining which schools are indeed green schools. Are these schools actually green schools? What are the differences in quality among green schools? At what point would the quality differences become so consequential that a lesser school could not be considered a green school? What meanings does the specification, green schools, convey?

An integrative assessment system for green schools' problems frequently involves a complex decision-making process in which multiple criteria and uncertain conditions must simultaneously be considered. Measuring and operationalizing the various features of readiness are complex and inherently imprecise, as they involve subjective conditions and information, linguistic assessments, and multiple and conflicting criteria. The multi-dimensional essence of an integrative assessment system for green schools justifies the use of Multi-Criteria Decision Making (MCDM) methods.

An often-cited definition of uncertainty, given by Hunter and Goodchild (1993) is, "the degree to which the lack of knowledge

about the amount of error is responsible for hesitancy in accepting the results and seeing without caution." Sources of uncertainty contain both vagueness and ambiguity. Vagueness characterizes data that lack clarity, and ambiguity characterizes data with several overlapping values. While vague data are uncertain because they lack detail or carefulness, ambiguous data are uncertain because they are subject to multiple explanations. An integrative assessment system for green schools' problems involves ambiguity and vagueness, and fuzzy sets theory has been widely used to handle imprecise and ambiguous data in MCDM.

Analytical hierarchy process (AHP) is a well-known decision support tool used for complex decision-making by providing a multi-level hierarchical structure for discrete decision-making problems.

This study uses FAHP with consistent testing methodology and FTOPSIS in order to establish the scientific support for and rational approach to the selection and creation of green schools for Iran. TOPSIS has also found wide use in decision-making applications over the past few decades (Tavana et al., 2013).

The motivations for the concatenation of AHP with TOPSIS in this study are threefold: 1) the concepts of positive ideal solution and negative ideal solution in TOPSIS are attractive for benchmarking purposes; 2) using TOPSIS after AHP avoids the predicament that the units under assessment are of the same value and cannot be properly ranked; and 3) various successful applications of the integrated AHP-TOPSIS methodology provide guidance in the literature (see, for example, Pires et al., 2015; Kluczek and Gladysz, 2015; Bai et al., 2016).

Since the field of assessment systems for green schools is varied, the aim of this study is to clarify that field by an integrative assessment system for Iran. Facilitating the discovery of potential green schools is discussed. Furthermore, there is scientific support in school selection, to avoid hasty choices and to respect the selection of these schools for development. This paper proposes that an integrative assessment system for green schools in Iran and in the system's current situation be tested. The proposed system will 1) utilize a set of an integrative assessment system for green schools' criteria that impacts green schools' readiness in a community; 2) lend importance to the weights of these criteria, with consistent testing methodology; and 3) provide an overall green schools' readiness score by incorporating these criteria into an integrative assessment system and fuzzy system.

This article is organized into 6 sections. In the next section, a review of the assessment systems for green schools is presented. In Section 3, research methods and underlying mathematical support are given. In Section 4, the evaluation framework is proposed. In Section 5, the pilot study and its findings, as well as limitations and future research directions are discussed. Finally, Section 6 presents the conclusions.

2. Assessment systems for green schools

According to the Center for Green Schools at the U.S. Green Building Council, a "green school" is a school building or facility that creates a healthy environment conducive to learning as well as saving energy, resources and money (Lysgaard et al., 2015). To build a green school, the systems and integrity of the green school must be fully examined from planning to monomer design, to reduce costs in the whole life cycle and to bring students from behavioral awareness to the education significance of green design (Zhao et al., 2015).

Many assessment systems for green schools exist to guide schools toward environmentally responsible choices (Henderson and Tilbury, 2004; Mogensen and Mayer, 2005; Zhao et al., 2015). These systems are typically comprised of a set of criteria that a

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