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Curriculum Change Parameters Determined by Multi Criteria Decision Making (MCDM)

Turan Erman Erkan ^{a*}, Babak Daneshvar Rouyendegh ^b

^a*Atilim University, Department of Industrial engineering Incek, Ankara 06836, Turkey*

^b*Atilim University, Department of Industrial engineering Incek, Ankara 06836, Turkey*

Abstract

Curriculum, research, instruction, learning and assessment are the pulse of the university. The main purpose of this study is to fill a substantial knowledge gap regarding reaching a uniform group decision in Industrial engineering curriculum design and planning. A comprehensive quality based course criterion model extracted from existing literature and expert opinions was developed. Multi Criteria Decision Making (MCDA) was used to identify the relative importance of course criteria for the purpose of tailoring an optimal four Industrial engineering curriculum for Bachelor's Degree students in Turkey. The hierarchical model and analysis utilized in the present study will be useful for resolving several important multi-criteria decision-making issues in planning and evaluating Industrial Engineering programs.

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1. Introduction

During the last decades, many efforts were made towards evaluating the effectiveness of curriculum change. Industrial Engineering Curriculums change more than the other engineering ones because of its nature. According to APICS (Association for Operations Management) Industrial Engineering is The engineering discipline concerned with facilities layout, measurement methods and improvement, statistical quality control, job design and evaluation, and the use of management sciences to solve business problems. Moreover according to It is concerned with the development, improvement, implementation and evaluation of integrated systems of people, money, knowledge, information, equipment, energy, materials, analysis and synthesis, as well as the mathematical, physical and social sciences together with the principles and methods of engineering design to specify, predict, and evaluate the results to be obtained from such systems or processes. Its underlying concepts overlap considerably with certain business-oriented disciplines such as operations management, but the engineering side tends to emphasize extensive mathematical proficiency and usage of quantitative methods.

The curriculum has many definitions, there are many literature researches about it. Parker and Quinsee (2012) is one of those. The remaining paragraph is from their study; There have been many definitions provided over the years with some of the most well known being those of Stenhouse (1987) who defined a “curriculum” as “...an attempt to communicate the essential principles and features of an educational proposal in such a form that it is open

* Corresponding Author: Turan Erman Erkan. Tel.: +90-312-586-8351

E-mail address: ermanerk@atilim.edu.tr

to critical scrutiny and capable of effective translation into practice”, and Kelly (2009) who defined the curriculum as “the totality of the experiences the pupil has as a result of the provision model”. These definitions provide some good principles however throughout the projects we have been looking to develop one that staff can be familiar with and so have drafted the following definition that will be examined further over the next year. “Curriculum relates to all aspects of the student experience during their program both within the institution and beyond which enable them to engage in their learning and achieve their potential”. This all encompassing definition is designed to be more accessible to staff and enable them to appreciate that the curriculum is more than just the content they are delivering, but relates to the full educational experience of students, and potential staff, engaged in a process of co-creation of learning.

2. Curriculum Development, Implementation and Changes

Curriculum development has been described as a stepwise process or procedure of developing a program of studies, projects or course offerings for a group of people (learners in conventional schools and informal settings, artisans, prison inmates) (Onwuka, 1996, Oloruntegbe, 2003 and Oloruntegbe and Daramola, 2007, Oloruntegbe 2011). Although the structure of curriculum development has come to be fairly constant in the sense of being built on Tyler’s (1949) and Taba’s (1962) prescriptive models of goals and objectives, content or subject matter, method and evaluation, it has in the course of history being a ‘filling-up’ process (Onwuka, 1996). The four components listed were not arrived at once. Even after these four curriculum theorists have had cause to add more.

Curriculum development, implementation and changes are really hard to realize. Especially in industrial engineering because of its definition, curriculum change should be agile in order to keep both the lecturers and the students up to date.

There are three types of courses in the Industrial Engineering Curriculum; they are: core, focus and elective courses. Core courses are the courses that all the students should take such as: freshman calculus, physics, chemistry etc. Focus courses are the courses that students take as tracks such as: Operations Research track, Information Systems track and so on. Electives are the courses that students take according to their interest under focus areas.

3. Materials and Methods

Multi criteria decision-making (MCDM) is a modeling and methodological tool for dealing with the complex engineering problems. Multi-attribute decision-making (MADM) is the most well known branch of decision-making. It is a branch of a general class of operations research models that deal with the decision-making problems under the presence of a number of decision making criteria. The MADM approach requires the selection to be made between decision alternatives described by their attributes. MADM problems are assumed to have predetermined, and limited number of decision alternatives. Solving a MADM problem involves sorting and ranking.

The AHP is a well-known method for solving decision-making problems. AHP is one of the most widely used multi-attribute decision-making (MADM) methods. In this method, the decision-maker (DM) performs pair-wise comparisons, and, the pair-wise comparison matrix and the eigenvector are derived to specify the weights of each parameter in the problem. The weights guide the DM in choosing the superior alternative.

AHP, proposed by Saaty (1980) is a flexible, quantitative method for selecting among alternatives based on their relative performance with respect to one or more criteria of interest (Boroushaki, and Malczewski 2008, Lin et al 2007). The AHP resolves complex decisions by structuring the alternatives into a hierarchical framework. The hierarchy is constructed through pair-wise comparisons of individual judgments rather than attempting to prioritize the entire list of decisions and criteria simultaneously. This process generally involves six steps (Vahidnia 2007):•

Describing the unstructured problem,

- Detailed criteria and alternatives,
- Recruiting pair wise comparisons among decision elements,
- Using the eigenvalue method to predict the relative weights of the decision elements,
- Computing the consistency properties of the matrix, and

- Collecting the weighted decision elements.

The AHP techniques form a framework for decisions that use a one-way hierarchical relation with respect to the decision layers. The hierarchy is constructed in the middle level(s), with decision alternatives at the bottom, as shown in Fig.1.

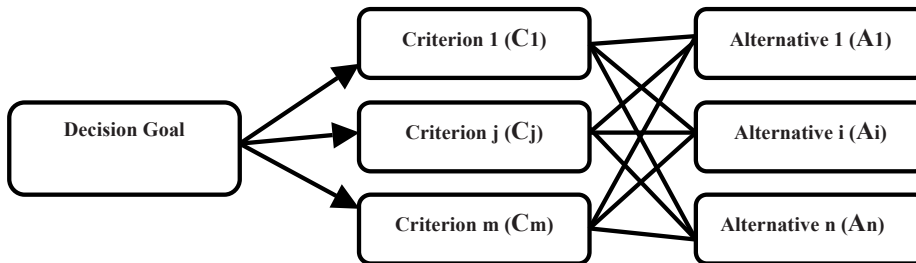


Figure 1 Hierarchy for a typical three-level MCDM problem

The AHP method provides a structured framework for setting priorities on each level of the hierarchy using pairwise comparisons that are quantified using a 1-9 scale as demonstrated in Table 1.

Table 1 The 1-9 the Fundamental Scale

Importance Intensity	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
3	Moderate importance of one over another	Experience and judgement slightly favour one over another
5	Strong importance of one over another	Experience and judgment strongly favour one over another
7	Very strong importance of one over another	Activity is strongly favoured and its dominance is demonstrated in practice
9	Extreme importance of one over another	Importance of one over another affirmed on the highest possible order
2,4,6,8	Intermediate values	Used to represent a compromise between the priorities listed above

This research had been conducted by a group of academicians. Two alternative curriculums had been determined like Curriculum A and Curriculum B. Both curriculums consist of core, focus and elective courses. Curriculum B has more focus and elected courses according Curriculum A, so Curriculum A is a classical one and Curriculum B is an updated one according to industry and scientific conditions. Selected academicians, had filled AHP tables for choosing the alternative curriculum. The criteria were: core, focus and elective. After they filled the AHP tables, the calculations were done by them and consistency check was realized.

3. Result

When the AHP method is applied, the resulting score is always ‘the-bigger-the-better’. As seen in Table 2, the Curriculum B (0,65) the top score due to its highest efficiency and performance. The Curriculum A (0,35) has the lowest score, and is ranked in the second and last place.

Table 2: The AHP ranking score

Curriculum	Curriculum A	Curriculum B
Ranking scores	0,35	0,65

4. Conclusion

This study serve to focus attention on the curriculum choosing among classical versus updated one according to industry and scientific needs. The curriculum efficiency measurement framework used in this study provides a useful mechanism to gauge the perceptions of academicians. While doing so, AHP-based decision analysis process took place among two alternative curriculums. This study provides a framework to assess how well curriculums meet user needs along six major dimensions: Core, Focus and Elective courses by using AHP method From the surveys that hold on AHP technique among 6 academicians; Curriculum A has a score (0,35) and Curriculum B has (0,65). This study could aid both academicians and industry representatives who want to change curriculums.

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