MIS Textbook Selection Using Analytic Hierarchy Process

Farrokh Mamaghani, St. John Fisher College, 3690 East Avenue, Rochester, NY 14618; E-mail: fmamaghani@sjfc.edu

ABSTRACT

Many business schools and individual faculty members are faced with decisions regarding the evaluation and selection of a MIS textbook for their courses due to the availability of many choices on the market. This evaluation and selection requires a multiple criteria decision-making method. The purpose of this paper is to apply the Analytic Hierarchy Process (AHP), a well-known multiple criteria decision making method, designed for decisions that require the integration of quantitative and qualitative data, to evaluating and selecting a MIS textbook.

1. INTRODUCTION

In today's classroom, textbooks serve as a tool, tutor, guidebook, and gauge (Association for Supervision and Curriculum Development, 1997). Teachers throughout the world base approximately 50 percent of their weekly teaching time on textbooks (Schmidt, McKnight, & Raizen, 1996). Therefore, selecting a proper textbook for a course has been one of the most important tasks for faculty. In order to help teachers select the proper textbooks, much research has been done to evaluate different textbooks at grade schools (Cohen, 2005; Dove, 1998). However, very little research is devoted to evaluating the textbooks used at the college level. Thus, it is no surprise that there is not much research done in regards to the evaluation and selection of textbooks for courses in the MIS field. While there is no indication of patterns of how MIS instructors select textbooks and the exact role the textbooks play in the classroom, which needs further study, at least one thing is certain— a majority of the instructors teaching MIS courses would like to have a textbook that would best meet their students' needs and become a good resource for other class activities such as case study analysis and discussion. A study of nearly eighty syllabi posted on the World Wide Web reveals that the majority of MIS instructors depend heavily on a textbook as a teaching tool in their courses. The proliferation of syllabi on the Web presents for the first time the possibility of gaining a comprehensive picture of how MIS survey courses are taught and how textbooks are used in them.

2. DETERMINING STUDY PARTICIPANTS

Textbooks may not be able to be rewritten or revised periodically, but the selection of textbooks can be done on a periodical basis. Therefore, instructors of MIS courses should evaluate available MIS textbooks frequently and select a textbook that meets their course objectives and incorporates the "voices" of all involved parties into consideration.

There are many factors that enter into the textbook evaluation and selection process and we will not attempt to be exhaustive in listing several general factors that may be involved. In the following sections, we will identify the parties that will either directly (faculty and students) or indirectly (employers) be affected by the choice of a textbook.

2.1 Instructors' Input

Decisions regarding textbook selection can only be made in the context of the particular learning situation in which they will be used and are influenced by a variety of factors. Besides the personal preference of an instructor, the evaluation and selection decision may be affected by factors such as content, availability of assessment tools and ancillary materials, a Web site, and price. As we mentioned earlier, this is not a complete list of factors that influence the choice of a textbook. However, we choose these factors to demonstrate our selection methodology.

2.2. Students' Input

Some of the students, whose needs are not met by a textbook, will lose interest and complain that they spent too much money on the textbook(s). Modern constructivist theories therefore believe that learning really takes place when the student can construct the new information into his/her original cognitive system (Jarvinen, 2001). In other words, students' needs have to be met in order to reach the goal of meaningful learning. Therefore, it is sensible to incorporate students' desires when considering the selection of textbook(s) in order to meet their needs.

To solicit students' inputs we conducted a survey in four sections of a 300-level Information Systems course, Information Technology Management, consisting of 106 students, as the sample for this study. This course is required for accounting and management majors in the AACSB accredited Business School, since it provides a comprehensive overview of the field of information technology management. The survey solicited students' feedback regarding various aspects of the textbook that was use during the course.

2.3. Employers' Input

Besides instructors' and students' needs, there is another equally important consideration for the selection of a MIS textbook. Since the information technology field is ever changing, teaching MIS courses requires instructors to equip themselves with the most up-to-date knowledge and technology. Therefore, one of the qualities of MIS textbooks that teachers should be looking for is adaptability. The textbook should not only be adaptable to new organizational developments, but also to the needs of local employers, based on the fact that most MIS graduates find jobs locally. However, most MIS textbooks are written in the view of being used nationwide. Therefore, they may not necessarily parallel the needs of local employers. Consequently, identifying local employers' needs and incorporating them into the process of selecting MIS textbooks is also important.

2.3.1 Employer Participant Selection

In order to select local employers to participate in this study, we asked the College's Career Services to identify the top 20 local employers of our accounting and management majors for the past five years. Following the approach used by and (Watson, 2000) each employer was initially contacted to identify the individual(s) in charge of hiring new graduates. Then each individual was asked about his or her willingness to participate in the study and twelve were selected. An important objective of the participant selection process was to solicit a diverse and well-informed viewpoints.

2.3.2. Data Collection

Telephone interviews were conducted to gather employers' feedback. The interviews were 20-30 minutes in length, including the introduction, and were comprised of the five questions. These questions were selected based on the review of AACSB requirements and 10 appropriate and current MIS textbooks on the market. At the end of the interviews the participants received a transcript of the telephone interview and were asked to review it for accuracy and add comments where appropriate.

3. METHODOLOGY

To incorporate all the voices, it is necessary to find a helpful methodology which provides for inclusion of quantitative as well as qualitative data. Analytical

Hierarchy Process (AHP) is an extremely useful methodology in this case. AHP has been known as a very useful multi-criteria decision making methodology to help decision makers select the best alternative among several available choices (Al-Subhi & Kamal, 2001; Bayazit, 2005; Lari, 2004).

Therefore, this paper attempts to demonstrate how AHP can help instructors to evaluate and select an appropriate MIS textbook for their courses with the inclusion of quantitative and qualitative factors from instructors, students and future employers, in the decision process.

4. AN OVERVIEW OF ANALYTIC HIERARCHY PROCESS

Saaty's Analytic Hierarchy Process (Saaty, 1995) has three major components:

1. Problem structuring – the formation of levels in a hierarchy,
2. Preference Assessment –prioritization, and
3. Synthesis

The AHP is unique in that it allows the quantification of intangibles through the construction of the problem in a visual hierarchical manner. This permits relationships between the ultimate goal, the criteria of choice and the alternatives to be clearly delineated in the decision-making process. This in turn functions as an aid to breaking the communication barrier that may exist between decision makers due to their different backgrounds, training and motivation. The hierarchy serves to create priority structures relevant to a specific decision problem. In deriving these priorities a distinction is made between local priorities that reflect the importance of an element at a lower level, those at a level higher in the hierarchy, and global priorities that reflect the importance of a criteria element with in relation to the focus of the problem. The basic AHP procedure consists of the comparison of pairs of factors within a set of reciprocal matrices.

The values in the matrix so formed indicate the strength by which one element dominates over another with respect to specific criterion by which they are being compared. Such a matrix is of the type:

$$A = \begin{Bmatrix} W_1 & w_1/w_2 & w_1/w_3 \ldots\ldots\ldots\ldots\ldots w_1/w_n \\ W_2/w_1 & & \\ \ldots\ldots & & \\ w_n/w_1 & & w_n/w_n \end{Bmatrix}$$

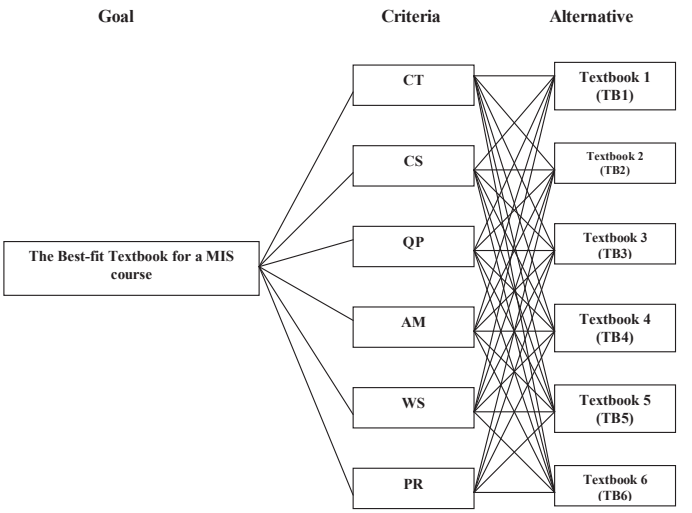
where every element wi/wj is representative of the a_{ij} comparison. Obviously if the i^{th} element is compared to the j^{th}, a comparison is also being made of the j^{th} with the i^{th} element (w_i/w_j, a_{ji}) causing the matrix to be a reciprocal matrix satisfying the criterion

$$a_{ij} = 1/a_{ji}$$

Since the comparisons may be qualitative, a scale capable of eliciting judgments from people in a consistent manner is needed, which also presents the flexibility to make judgments based on experience and personal expertise rather than on an absolute numerical value. Saaty uses a scale 1-9 based on the finding that an individual is incapable of simultaneously comparing more than seven alternatives (plus or minus two) (Miller, 1956, Saaty, 1977).

In this study we used scale 1 for equal importance (two factors contribute equally to objective), scale 3 for weak importance of one over another (experience and judgment slightly favor one factor over other), scale 5 essential or strong importance (experience and judgment strongly favor one factor over other), scale 7 for demonstrated importance (one factor is strongly favored and its dominance is demonstrated in practice), scale 9 for absolute importance (the evidence favoring one factor over another is of the highest possible order), and scales 2,4,6,8 as intermediate values. If factor i has one of the above non-zero numbers assigned to it when compared with factor j, then factor j has the reciprocal value when compared with i.

Figure 1. Decision hierarchy



5. USING AHP TO EVALUATE AND SELECT A MIS TEXTBOOK

5.1. Problem Structuring

In this study, a small group of evaluators comprised of three faculty members in charge of teaching MIS courses in an undergraduate accounting and management program discussed and brainstormed to generate evaluation criteria and identify alternatives. After initial deliberation, members of the evaluation team prepared a short survey to solicit inputs from students as well as several potential employers. After analyzing the results of these surveys, the evaluation team identified the following six evaluation criteria and six widely used MIS textbooks currently available in the market as the selection alternatives. These evaluation criteria were:

1. Content (**CT**)
2. Real World Case Studies (**CS**)
3. End of Chapter Questions and Problems (**QP**)
4. Ancillary Materials (**AM**)
5. Web Site (**WS**)
6. Price (**PR**)

Figure 1 shows the decision hierarchy.

5.2. Weighting the Criteria

After construction of the decision hierarchy, the second step was to assess the relative importance of criteria. An AHP evaluation is based on the decision maker's judgments about the relative importance of each criterion in terms of its contribution to the overall goal as well as preferences for the alternatives relative to each criterion. Therefore, in this example the evaluation team needs to specify their judgments about the relative importance of each of the six criteria.

Establishing priorities among criteria was based on pair-wise comparisons. A meeting with members of the evaluation team was scheduled to make pair-wise comparisons among criteria and available textbooks.

Table 1 shows the comparison matrix, which indicated the results when evaluating the relative importance of the criteria in a pair-wise fashion. The entries in the matrix consist of one's on the main diagonal and reciprocals of the ratings in the cells below the diagonal. The assignment of one's to the main diagonal is based upon the fact that when we compare any criterion against itself, the judgment must be that they equally preferred. The elements below the diagonal are reciprocals of those above because if, for example, content (CT) is eight times more preferred than case studies (CS), then (CS) must be one-eighth as preferable as (CT).

Table 1. Criteria comparison matrix

Criteria	CT	CS	QP	AM	WS	PR	Average
CT	1	8	5	8	8	9	.496
CS	1/8	1	1/3	4	5	5	.129
QP	1/5	3	1	7	7	7	.225
WS	1/8	1/4	1/7	1	1/3	1/5	.029
AM	1/8	1/5	1/7	3	1	1/3	.046
PR	1/9	1/5	1/7	5	3	1	.076

Table 2. Pair-wise comparison of how the selected textbooks address the content criterion

	TB1	TB2	TB3	TB4	TB5	TB6	
TB1	1	1/3	1/2	1/2	3	3	.124
TB2	3	1	3	3	5	5	.376
TB3	2	1/3	1	3	5	5	.247
TB4	2	1/3	1/3	1	3	3	.148
TB5	1/3	1/5	1/5	1/3	1	1	.052
TB6	1/3	1/5	1/5	1/3	1	1	.052

5.2.1. Calculating the Relative Weights(Priorities) of Criteria

While the AHP is an easy-to-understand methodology, the mathematical calculations required to derive priorities from pair-wise comparisons involve what are known as *eigenvalues* and *eigenvectors* and may turn out to be difficult and time consuming without a computer program. Although the Expert Choice software (http://www.ExpertChoice.com) easily performs these calculations, however these calculations can be carried out using a spreadsheet software, to obtain an approximation of the priorities.

The row averages of .496, .129, .225, .029, .046, and .076 in Table 1 provide an approximation to the priorities of the evaluation and selection criteria. Based on these priorities, content (CT) is the most important (preferred) criterion followed in importance by end of chapter questions and problems (QP), real world case studies(CS), price(PR), ancillary materials (AM), and Web site(WS).

5.2.2. Pair-wise Comparisons of Textbooks with Respect to Each Criterion

Tables 2 show the comparison matrix indicating the pair-wise evaluation on how the selected textbooks address Content (CT) criterion.

Similar tables should be constructed for CS, QP, WS, AM, and PR criteria.

Table 3 provides the relative importance of the textbooks by criterion type. For example, using the textbook comparison matrix for the content criteria (CT), the normalized eigenvector is calculated; it is shown in the CT column. Larger values of the eigenvector indicate a greater importance of textbook with respect to the criterion. Thus, TB2 best addresses the content criterion, followed in decreasing order by TB3, TB4, TB1, TB5, and TB6. This process of calculating the normalized eigenvector is repeated using the textbook comparison matrices for content (CT), case studies (CS), end of chapter questions and problems (QP), ancillary materials (AM), Web site (WS) and price (PR). Results of these calculations are provided under their respective columns. The results indicate that TB2 is the best-fit textbook alternative when considering the content criteria, TB3 is the best textbook when examining the Web site criteria, and TB2 is the best alternative when considering real world case study criteria.

The normalized eigenvector of the criteria comparison matrix is also shown in Table 3. It indicates the relative importance of the criteria based on the evaluation team members' data. The computational results yield the following: content(CT) is the most important, followed in importance by end of chapter questions/problems(QP), real world case studies(CS), price(PR), ancillary materials(AM), and Web site(WS).

Table 3. Relative importance (normalized Eigenvectors)

	CT	CS	QP	WS	AM	PR
Criteria Relative Priority	.496	.129	.225	.029	.046	.075
TB1	.124	.030	.029	.104	.054	.130
TB2	.376	.446	.466	.278	.202	.150
TB3	.247	.268	.287	.278	.299	.308
TB4	.148	.032	.052	.156	.178	.114
TB5	.052	.078	.083	.156	.178	.237
TB6	.052	.145	.083	.027	.089	.060

Table 4. Composite prioritization

	CT	CS	QP	WS	AM	PR	
TB1	.496*.124 +	.129*.030 +	.225*.029 +	.029*.104 +	.046*.054 +	.075*.130 =	.087
TB2	.496*.376 +	.129*.446 +	.225*.446 +	.029*.278 +	.046*.202 +	.075*.150 =	.378
TB3	.496*.247 +	.129*.268 +	.225*.287 +	.029*.278 +	.046*.299 +	.075*.308 =	.267
TB4	.496*.148 +	.129*.032 +	.225*.052 +	.029*.156 +	.046*.178 +	.075*.114 =	.111
TB5	.496*.052 +	.129*.078 +	.225*.083 +	.029*.156 +	.046*.178 +	.075*.237 =	.085
TB6	.496*.052 +	.129*.145 +	.225*.083 +	.029*.027 +	.046*.089 +	.075*.060 =	.073

Table 4 illustrates the final overall prioritization of the six textbook alternatives. From this, the order of prioritization would be TB2, TB3, TB4, TB1, TB5, and TB6.

6. CONCLUSIONS

The purpose of this paper is to present a structured and systematic methodology, the Analytical Hierarchy Process (AHP), for the evaluation and selection of a MIS textbook. The methodology performs multiple criteria evaluation through a pair-wise weighting process for all criteria. This methodology allows a decision maker to incorporate qualitative as well as quantitative data in the decision process and offers a rigorous model on which a complex decision problem can be dealt with effectively. The evaluator does not have to reach an overall judgment in a single phase. Instead, the evaluator can (1) determine the relative significance (or importance) of the criteria through a relatively simple pair-wise comparison of two criteria, one at a time, then (2) evaluate textbooks under each criterion through a pair-wise comparison of each two textbooks one at a time, and (3) the AHP model will automatically present the solutions in terms of the evaluation of each textbook based on all criteria as well as on each single criterion.

In this paper six MIS textbooks were evaluated based on content, real world case studies, end of chapter questions and problems, ancillary materials, Web site, and price as the decision criteria. While the application described in this paper was carried out using a spreadsheet, an interactive commercial computer program (Expert Choice) is available that computes the priority vectors. Major conclusions from similar applications of the AHP were that it was found to be valid, flexible, and easy to apply and did not overlook any significant factor.

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