Accommodating Analytic Hierarchy Process (AHP) for Elective Courses Selection

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Abstract:

The determination of elective courses for students is one of many things that require some complex considerations. This complexity is motivated by psychological and non-psychological factors of human beings such as: learning motivation, lecturer and previous learning experience. Many students found difficulties if they have to decide in a complex options in which has the identical option. Thus, they made their decisions based on just one perceived factors alone without taking into account other factors which have great importance as well. Analytic Hierarchy Process (AHP) is one method that can be used as an appropriate decision supporting tool to reduce the complexity of decision making process. AHP provides analysis in the form of selected course recommendations that have a weight of rankings to the level of importance of each preferred alternative. This study subjected to construct the real consideration from students' point of view. In which very important to create a hierarchical perspective order for decision making process in both sides, student and education provider which was on Accounting Education Department, Faculty of Teacher Training and Education, Universitas Sebelas Maret Surakarta.

Keywords: elective courses, decision making, analytic hierarchy process

Introduction

Department of Accounting Education is one of the existing department at Universitas Sebelas Maret which is incorporated in the Faculty of Teacher Training and Education (FKIP). There are two categories of courses that exist in accounting education courses are compulsory subjects and elective courses. Compulsory course is a course that must be taken by students in each semester in accordance with the package that has been determined by the department of accounting education. Elective courses are free courses taken by students. The selection of elective courses depends on the students' academic interests and abilities (Abang M. Zaid Wahyu, 2017). But in fact, students are often confused in determining the course of choice that will be taken. As a result most of them just follow-friends, there are also choosing the course because considering the lecturer who teach and only origin in choosing the course (Wijayawati, 2004). The majority of students are unaware of their interests and abilities are located in what part so that in choosing elective courses not through mature thinking.

Meanwhile, in setting the elective course choosing, students need to think through to several considerations. If the course is not able to be followed by the students it will create difficulties for the student. Students must consider various factors that are psychological and non-psychological factors such as self-motivation, lecturer, and learning experience that has been obtained before so that by choosing the course will give a good impact for the students (Marwanto, 2015; Sukmayasa, 2015). Accuracy in choosing a course can also provide supplies in the future when in the world of work.

From the short background above, this study identified some important problems in selecting elective courses, such as:

1. Lack of student consideration in determining elective courses

2. Most students make decisions based on just one of the factors alone without taking into account other factors

3. Lack of self-recognition in choosing courses that match their interests and abilities.

Based on the above conditions, it is important to develop and create a system that can help students to choose the elective courses that match to their interests and academic ability, with decision support system using AHP (Analytic Hierarchy Process) method (Saaty, 2007), this would become the objective of this study since AHP method can give an analysis in the form of recommendation of elective courses that have a weight that is rank on the level of importance of each alternative choice so that the student no longer confused when setting the selected subject according to its ability.

Methodology

The population used in this study is the Department of Accounting Education Universitas Sebelas Maret, which includes lecturers and students. An interview with the lecturer / expert board will be conducted to get a justification of the hierarchical form of the proposed problem. The sample set is 6th semester students or students who have achieved the enough credits to take elective courses. The sampling technique used was purposive sampling with the aim of being able to provide complete and meaningful information in this study. But since the number of samples is not so large, the sample will be taken entirely.

Data collection is carried out in accordance with the needs of AHP research which requires using two different methods. Structured interviews were used to obtain qualitative information, while questionnaires were used to

1. Structured interview method. The interview technique involves direct dialogue between lecturers, study program managers and students. Information is collected with the help of recording devices, notes and so on, then transcribed, analyzed and encoded. Structured interview method is a systematic goal-oriented process. The systematic structure reduces the inherent interpretation problem and allows the knowledge engineer to prevent distortion caused by the subjectivity of the interview.
2. Questionnaire. To find an applicable AHP model, all student entities that have the right to take elective courses with questionnaires based on the AHP approach are by using a pairwaise comparison matrix.obtain quantitative data.

Literature Reviews

According to Alter (2002) in Kusrini (2007)) decision support system (DSS) is an interactive information system that provides information, modeling, and manipulating data. In addition it is used to help decision making in semi-structured situations and unstructured situations, where no one knows for sure how a decision should be made. Whereas according to (Daihani, 2001) the DSS concept was first revealed around the beginning of 1970 by Michael S. Scott Morton who explained that DSS is a computer-based system that is intended to help make decisions in utilizing certain data and models to solve various problems unstructured (Efraim Turban, Jay E. Aronson, & Liang, 2007). Decision support system provides information, guides, provides predictions and directs information users to make better decisions.

The purpose of Decision Support Systems (Efraim Turban et al., 2007) are as follows:

1. Helping managers in making decisions on semi issues structured.
2. Provide support for the manager's consideration and not on intended to replace the manager's function
3. Increase the effectiveness of decisions taken by more managers rather than improving its efficiency
4. Computational speed. Computers allow takers the decision to do lots of computing quickly at a low cost
5. Increased productivity. Build a group of takers decisions, especially experts, can be very expensive.
6. Quality support. The use of computers can improve the quality of decisions because it is able to store a lot of data, can perform complex simulations, is able to examine many scenarios, fast, and economical.
7. Competitiveness. The existence of competition requires organizations to be able to frequently and quickly change the mode of operation, reengineering processes and structures, empowering employees, and innovating. The use of decision support system is able to solve these problems
8. Overcoming cognitive limitations in processing and storage. The human brain has a limited ability to process and store information.

People sometimes have difficulty remembering and using information in error-free ways. One of the method that can be used to accommodate the difficulties and complexity on this stage is Analytic Hierarchy Process (AHP).

Analytic Hierarchy Process

Known as a method for solving a complex situation that is not structured into several components in a hierarchical arrangement (Saaty, 2000), by giving a subjective value about the importance of each variable in relative terms, and determining which variables have the highest priority in order to influence the results in the situation (Kahraman, Cebeci, & Ulukan, 2003). The decision-making process is basically choosing the best alternative. Such as structuring the problem, determining alternatives, determining probable values for the agreeable variable, setting values, preference requirements for time, and specifications for risk (Saaty, 2000). No matter how wide the alternatives that can be determined or the detailed assessment of possible values, limitations that remain overlapping are the basis of comparison in the form of a single criterion. With hierarchy, a complex and unstructured problem is broken into its groups and arranged into a hierarchical form (Kim, Kim, & Youn, 2012).

In solving problems with explicit logical analysis, in this model management system will be discussed about the steps used in the AHP (Analytical Hierarchy Process) method with the following steps (Saaty, 2004):

1. Decomposition After interpreting the problem, decomposition can be done, which describes the elements in the problem. This can be done until you find a solution to the problem.
2. Comparative Judgment At a certain level there is a relationship with the level above which this guide can produce a judgment about the relative two elements. The results of the assessment can be displayed by comparison in pairs and produce a matrix (Pairwise Comparasion).
3. Priority Determination (Synthesis of Priority) Each pairwise comparison matrix can generate local priorities. Because in each level the matrix has a pairwise comparison, so that in determining global priorities can synthesize each local priority. According to a hierarchy, the

synthesis is not the same. In a variety of problems, a way of addressing opinions is the best scale, namely a scale of 1 to 9.

4. Logical Consistency Consistency has two meanings, first is an Eigen Value and similarity can be put together and produce the same object. The second is a certain condition that has a base level of relationships between objects. This analysis is needed to find out how much influence or effect of AHP implementation in answering the existing phenomenon

Need analysis using the AHP method to help parties

Department managers obtain more accurate results. This design includes 2 stages, namely the process of analyzing software requirements and designing decision support systems using the Analytical Hierarchy Process (AHP) method.

The principle of arranging a hierarchy is to describe and describe hierarchically, by dividing the problem into separate elements (Saaty & Vargas, 2012). This is done by detailing knowledge, our complex thoughts into the basic elements, then this section into its parts, and so on hierarchically. The description of lower hierarchical goals is basically aimed at obtaining measurable criteria. Even though this is not always the case. In some cases, it may be more profitable to use objectives in a higher hierarchy in the analysis process (Kahraman et al., 2003; Saaty, 2007). The lower in describing a goal, the easier it will be to determine the objective size and criteria and sub-criteria. However, there are times when the decision making analysis process does not require too detailed elaboration. So one way to state the size of the achievement is to use a subjective scale and be analyzed using AHP processing software tools such as Expert Choice version 12.

Result

Based on interviews conducted to the respondents both on students and lectures we found Critical Factors that lead complexity to students while they have to choose elective subject. Short description of identified factors (students' perspective) is shown on table 1 below:

Table 1. Identified Factors and Description

No	Factors	Description
1	Fear	Fear is referring to the feeling of wanting to avoid the course
2	Assessment Design	The type of appraisal is the way the lecturer conducts the assessment during the skill.
3	Challenge	A determination to improve the ability, or the stimulus to overcome difficulties.
4	Classroom Environment	A classroom environment is the environment that will be experienced by students during teaching and learning activities in the courses taken.
5	Cognitive Ability	The ability of students in analyzing and logics.
6	Difficulty Level	Difficult feeling that may be felt in taking the course (related to other courses that are linear and have been taken)
7	Forced By Others	Term coercion is the pressure received from outsiders.
8	Friends' Preferences	The meaning of a friend is a close of best friend of the student.

9	Influenced Group	Referred to as reference group is a group that influences the decision of the majority of students, such as student organisation under department or faculty.
10	Interest/Curiosity	The sense of interest and curious is the feeling of wanting to choose a course.
11	Learning Model	A learning model is the suitability of learning model characteristics used by lecturers in the classroom.
12	Lecturer	The subjectivity of the student in assessing the candidate lecturer of the elective course
13	Motivation	A motivation from both inside and outside the student in taking the course.
14	Organisation	The involvement or activity of students within the organization inside and outside the campus.
15	Parents' Consideration	The input given by the parents to the students about the selected course
16	Personal Goal	Ideals is life expectancy in the future.
17	Psychomotor Skills	The ability of students in counting, luck in making financial reports etc.
18	Self-proving	The impulse to prove themselves, able in the selected subject.
19	Senior References	Feedback given to someone who has a view of the course, such as a senior student who undertaken the course previously.
20	Similar Courses' Grade	The characteristic. Assume that the course is a reflection of their talents, interests and abilities that must be developed through this majors process.
21	Working Opportunity	The employment field here is the student's view of future employment opportunities (after graduation)

As basic nature of AHP, those identified factors need to be structured hierarchically to three levels named Dimension, Criteria and Factor. In this case, we defined Dimension as the biggest consideration of students' perspective those are internal an external. Internal dimension meant all factors which came from persons' intentions in choosing elective course such cognitive, affective and psychomotor. While the external dimensions covers others influence and the policy from department of study. Following table shown the basic hierarchy on this matter, with their direct rate and ranking based on student perspective classification. This rates were calculated from respective respondents which responded the importance of the identified factors as selection criteria on their elective courses final decision.

Table 2: Important Factors in Decision Making of Elective Course Selection – Non AHP

Important Factors in Decision Making of Elective Course Selection – Before AHP				
Dimension	Criteria	Factor	Rate	Ranking
Internal	Cognitive	Similar Courses' Grade	0.604	8
		Working opportunity	0.792	4

		Cognitive skill	0.854	1
		Difficulty level	0.563	11
	Affective	Personal goal	0.771	5
		Motivation	0.854	2
		Fear	0.383	15
		Interst	0.826	3
		Challenge	0.750	6
		Self-proving	0.479	13
	Psychomotor	Numerical skill	0.583	9
		Verbal skill	0.040	22
External	Other Party	Senior references	0.660	7
		Friend preferences	0.125	20
		Influenced group	0.191	19
		Organisation	0.271	18
		Forced by others	0.043	21
		Family consideration	0.313	17
	Department	Lecturer	0.563	10
		Learning Method	0.521	12
		Learning Assessment	0.458	14
		Environment	0.375	16

Further, 48 respondents in the first stage were obtained to filled the AHP questionnaire that objected to find final construct of a hierarchical view on this occurrence. Only 18 respondents valid to the next AHP step. Validity of the respondents were shown by the inconsistency index on the calculation, while the inconsistency index more than 0.5 the questionnaire was invalid. From those 18 valid questionnaires, AHP could calculate the combination value of those respondents, and create the final construct of the AHP, as shown in picture 1 below:
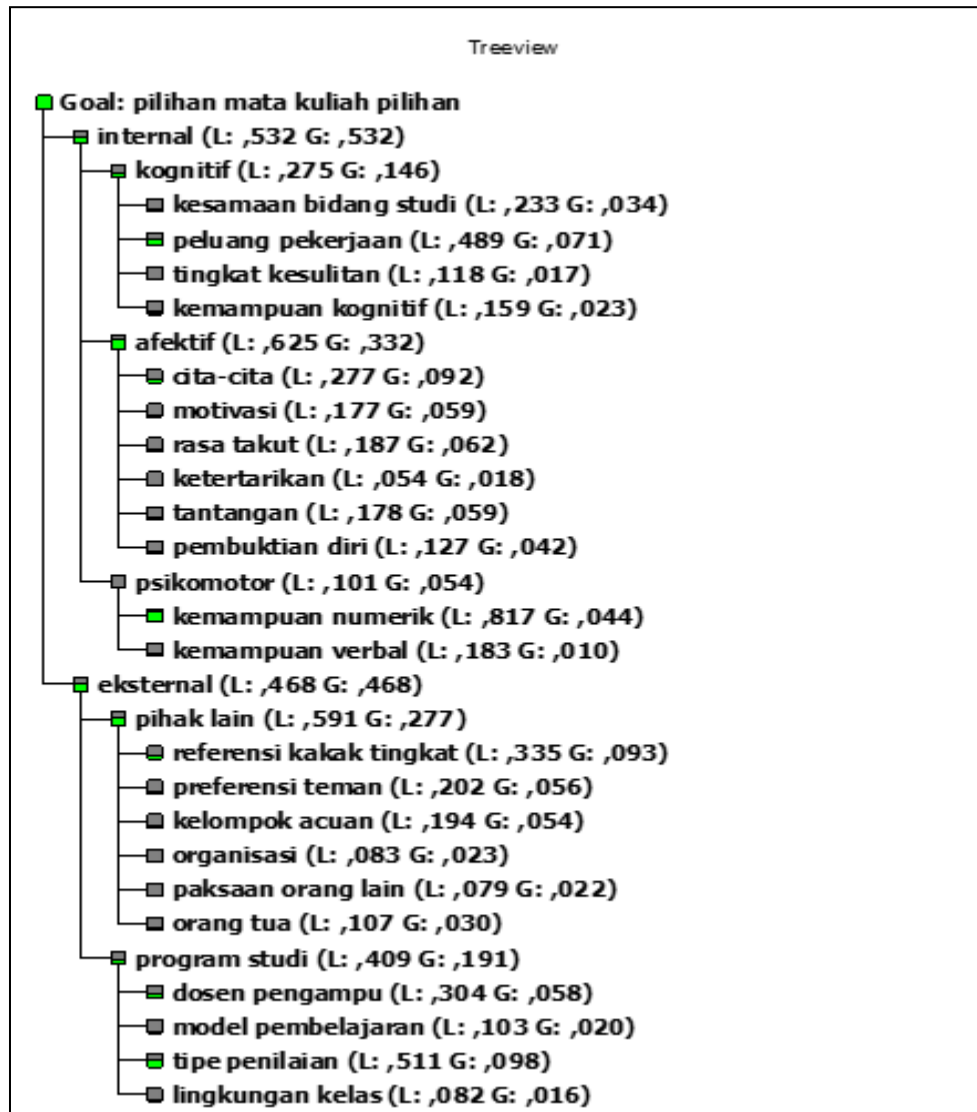
Treeview

□ **Goal: pilihan mata kuliah pilihan**
├─□ **internal (L: ,532 G: ,532)**
│ ├─□ **kognitif (L: ,275 G: ,146)**
│ │ ├─□ kesamaan bidang studi (L: ,233 G: ,034)
│ │ ├─□ peluang pekerjaan (L: ,489 G: ,071)
│ │ ├─□ tingkat kesulitan (L: ,118 G: ,017)
│ │ └─□ kemampuan kognitif (L: ,159 G: ,023)
│ ├─□ **afektif (L: ,625 G: ,332)**
│ │ ├─□ cita-cita (L: ,277 G: ,092)
│ │ ├─□ motivasi (L: ,177 G: ,059)
│ │ ├─□ rasa takut (L: ,187 G: ,062)
│ │ ├─□ ketertarikan (L: ,054 G: ,018)
│ │ ├─□ tantangan (L: ,178 G: ,059)
│ │ └─□ pembuktian diri (L: ,127 G: ,042)
│ └─□ **psikomotor (L: ,101 G: ,054)**
│   ├─□ kemampuan numerik (L: ,817 G: ,044)
│   └─□ kemampuan verbal (L: ,183 G: ,010)
└─□ **eksternal (L: ,468 G: ,468)**
   ├─□ **pihak lain (L: ,591 G: ,277)**
   │ ├─□ referensi kakak tingkat (L: ,335 G: ,093)
   │ ├─□ preferensi teman (L: ,202 G: ,056)
   │ ├─□ kelompok acuan (L: ,194 G: ,054)
   │ ├─□ organisasi (L: ,083 G: ,023)
   │ ├─□ paksaan orang lain (L: ,079 G: ,022)
   │ └─□ orang tua (L: ,107 G: ,030)
   └─□ **program studi (L: ,409 G: ,191)**
      ├─□ dosen pengampu (L: ,304 G: ,058)
      ├─□ model pembelajaran (L: ,103 G: ,020)
      ├─□ tipe penilaian (L: ,511 G: ,098)
      └─□ lingkungan kelas (L: ,082 G: ,016)

Figure 1: Final Weight on Decision Selection – AHP view

Final AHP prioritization model on elective subject selection decision is slightly different to the previous calculation – before AHP process, detailed prioritization and ranking of the final model is shown in figure 2.
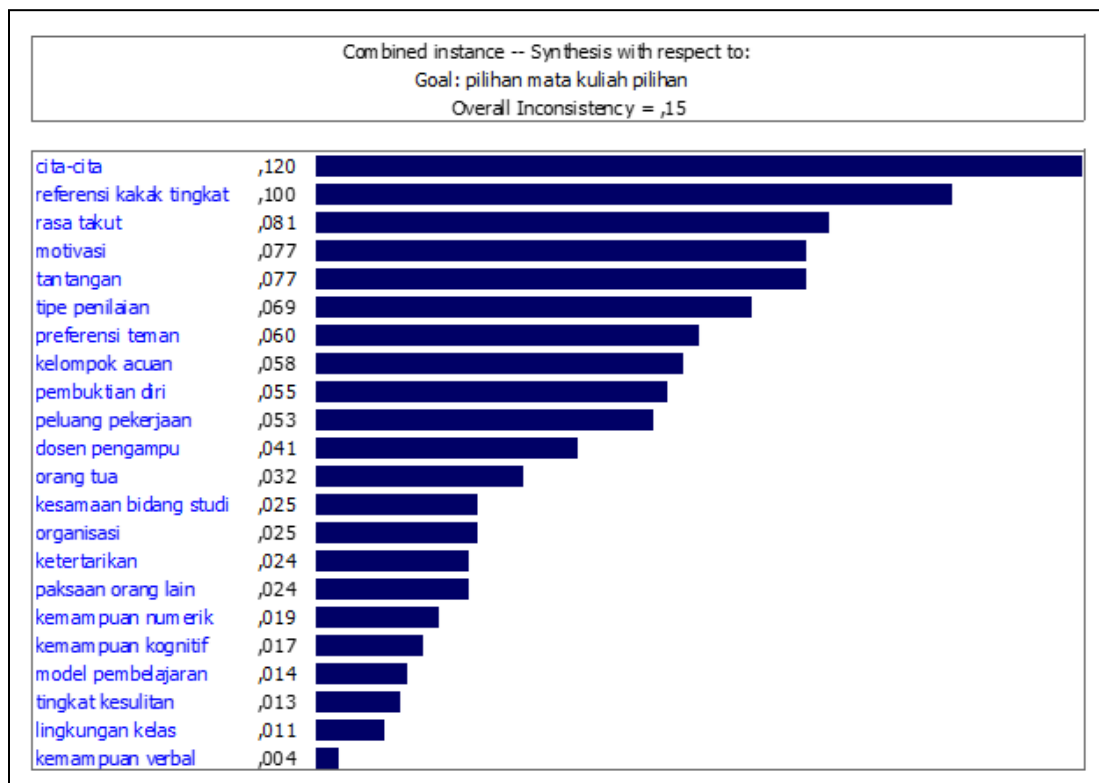
Figure 2: Final Prioritization and Ranking– AHP view

Based on the calculation of AHP, the factor of ideals is the most important factor in considering the choice of elective courses which is contributing 12%. Subsequently the sister references (10%), fear (8.1%), motivation (7.7%), challenges (7.7%).

Whereas consideration of verbal ability (0.4%), class environment (1.1%), difficulty level (1.3%) and learning model (1.4%) are factors that have no effect in determining this elective course.

Discussion

These twenty-one factors influence student decisions in choosing elective courses. In accordance with the theory stated by Asar Sunyoto, 2001, that cognitive, affective, personality traits, culture, family, social status, and reference groups are factors that influence student decisions in choosing concentration courses.

The most dominant factor influencing student decisions in choosing elective courses is cognitive factors, motivation and interest. As we know that cognitive is the abilities that arise from within the human being are obtained through the learning process. Science and mastery of technology that is owned will be able to deliver to decisions that will be taken by students especially in the selection of concentration courses. Cognitive or mastery of science knowledge controlled by students certainly go through a process in stages. Learning outcomes are an illustration of the mastery of science mastered by students, so that from the learning outcomes students are able to determine the concentration to be chosen.

Inadequate student decisions in choosing courses affect the length of the study period. This is due to the lack of students in understanding the characteristics of a course, and the limited time for guidance by an academic advisor. The existence of these problems needs to be built a Decision Support System (DSS). The system related to the selection of courses. The system should become an important information provider that helps organization, managers, and other parties to create proper and decision making. One of the Decision Support System methods could be used to comply with higher complexity is Analytical Hierarchy Process (AHP). This study focused on the early stages in incorporating AHP include determining criteria intensity, comparison of criteria and comparison of criteria intensity. Determination of AHP criteria includes: initial ability, reference, influence of friends, employment, and influence of lecturers.

AHP calculation has created the more crisp and rigid result in shaping the student motives and needs of selecting elective subject, related to the decisions of students in the selection of concentration courses it is

recommended to develop this research by developing the same method in different agencies or majors. This is useful to test the validity of the findings of the factors that influence student decisions in the choice of concentration courses so that the results are optimized.

There needs to create synergy among stakeholders related to the determination of elective courses, in addition to accommodating the National Curriculum Standardization (SKKNI) or generally accepted curriculum, elective courses should answer the basic questions of students, namely how important this course is for their future. The central role of the lecturers is the important thing that emerged as the basis for this election. Reconstruction and evaluation of curriculum are vital in achieving the vision and mission of the study program, especially in the field of education and teaching.

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