Expert system on core competency detection and student achievement based on Fuzzy TOPSIS method

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Expert system on core competency detection and student achievement based on Fuzzy TOPSIS method

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Abstract. The improvement of information technology is experiencing rapid development. The expert system experienced a rapid increase so that it is helpful to human needs in resolving existing problems. The following research has built intelligent systems based on the fuzzy TOPSIS method intending to help to detect core competencies and student achievements. Testing system on the expert system based on the Fuzzy TOPSIS method the conditions in the Ministry of Education Islamic Religion Faculty of Tarbiyah and Islamic State University Maulana Malik Ibrahim Malang. The results show quite a good result that can help in making process decisions. From testing showed that the fuzzy method of TOPSIS resulted in a pretty good level of accuracy in expert systems on core competency detection and student learning achievements.

1. Introduction

State Islamic religious college is a strategic unit of education in preparing outstanding human resources and excellence. Global competition demands that universities should be able to deliver their students to compete globally both nationally and internationally. The quality of higher education graduates, including the state Islamic religious college, can be measured from how the level of achievement of student learning and the level of graduates in the field of employment as well as their field of expertise. Because of that, the quality of the college can be measured. One of them is from how the state Islamic religious college prepares students to be able to master the core competencies and produce graduates who achieve the best. Student learning achievement is demonstrated through the performance of academic, intellectual, skill, and moral skills, personality attitudes. The success of achieving high learning achievements in lectures in higher education becomes the ideals and expectations of every student. High learning achievement is expected to have implications for the ease of obtaining decent work and being able to compete openly in global competition. However, each student faces various obstacles, challenges, and various difficulties so that during the lecture, it is not certain that every student can face challenges and succeed in achieving the aspirations.

The technique for Order Performance by Similarity to Ideal Solution (TOPSIS) is a well-known method Multiple Criteria Decision Making (MCDM) problem. Some fuzzy criteria in decision making have an important role in solving problems in the decision-making process. Among the popular methods used in solving such problems is the Fuzzy TOPSIS, where solutions are produced based on the shortest distance from the ideal positive solution and the farthest distance from the ideal solution that is negative [1]. Related research uses the implementation of the evaluation and selection of projects that propose to project assessment and assist in the decision-making process of choosing the wrong One of the best results for oil companies in Iran [2]. The research uses six criteria to compare alternative investments as criteria in the utilization of AHP methods and Fuzzy TOPSIS methods. The AHP method is used to analyze the problem structure of the project selection and to determine the weight of a criterion, while

the Fuzzy TOPSIS method is used to perform the final rating. The final results of the study were conducted to illustrate the use of models in project selection issues. The research shows the result of calculating the weight of criteria in the implementation using the Fuzzy TOPSIS method by changing the criterion rating.

Decision making can use a combination of different weights according to the criteria rating priority. Fuzzy TOPSIS can be used to solve decision-making problems by doing a summation of multiplication operations on the triangular fuzzy number (TFN). Based on the background discussion, the following studies have researched the development of the Neural Network-based Fuzzy Topsis optimization applied to an expert system in detecting student learning in measuring Instrument indicators development of core competencies and internal and external factors affecting the success of learning achievement achieved by students. The implementation of expert systems in detecting student learning can help students and lecturers in decision making to support the improvement of student learning achievement. This development was done to produce expert system applications by optimizing the Fuzzy TOPSIS method on the expert system of detection of core competencies and learning factors affecting student learning achievement. The research is integrated with the use of Fuzzy TOPSIS based on neural networks (NN) because it is very effective for the digging process. Fuzzy logic is often used to solve complex problems. The Neural Network is a representation of a human brain performance that seeks to mimic the way the human brain works to solve existing problems.

2. Literature review

Another study implemented the Fuzzy TOPSIS method on the Supply Chain Management (SCM) problem. The research object is in one of the companies in India by applying many criteria [3]. Research related to the combination of statistical analysis, fuzzy theory, and TOPSIS to evaluate the service quality of rail transit. Analysis results show the stableness of the fuzzy TOPSIS method by the ranking change of service quality for a line from different comparison sets of metro lines and provide suggestions and guidance for the optimization of rail transit infrastructure and investment [4].

Research related to making the best selection on the recycling method involves complex decision variables is considered to be a multiple criteria decision-making (MCDM) problem. Research for taproot an evaluation model based on the Fuzzy Analytic Hierarchy Process (AHP) and the technique for order performance by similarity to ideal solution (TOPSIS) to enable the industry practitioners to perform performance evaluation in a fuzzy environment. The results of the study are to determine the best method for recycling plastics among the various plastic recycling processes and identify that the mechanical recycling process is found to be the best plastic recycling process using the integrated approach [5].

3. Problem definition

The use of sections to divide the text of the paper is optional and left as a decision for the author. Where the author wishes to divide the paper into sections the formatting shown in table 2 should be used.

4. Research methodology

Following is the stage in research with the R & G approach.

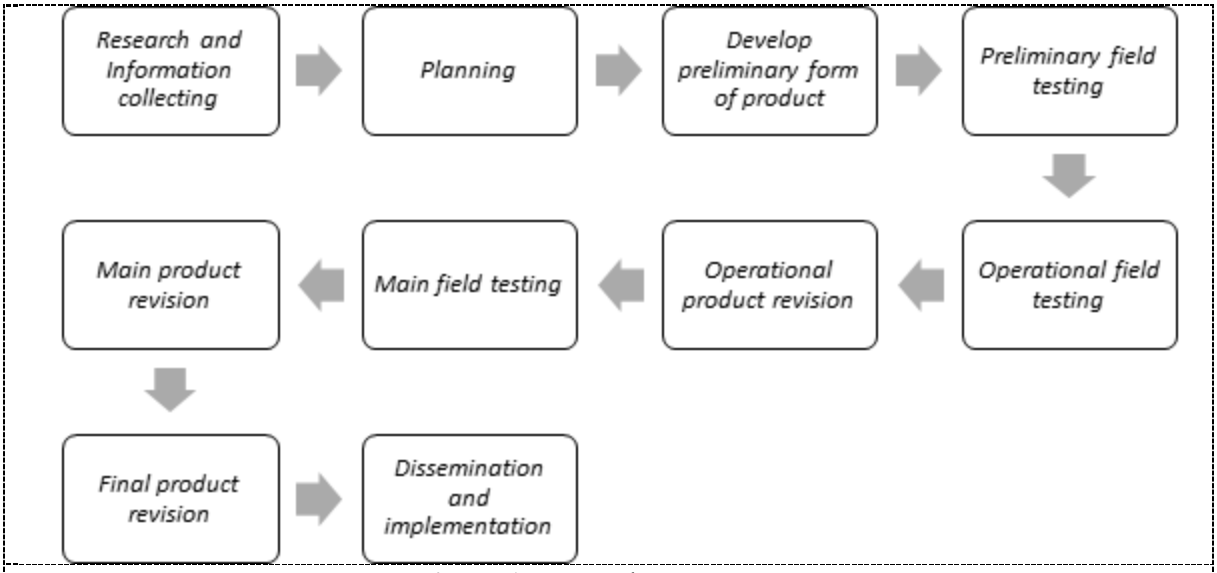

Figure 1. Research Steps R & D

1. Potential and problems.
Research always begins with potential or problems. Likely is everything that if you are going to have added value. Questions can also be turned into potential if researchers can power the problem. The problem will occur when there are irregularities, among which are expected with the circumstances occurring. Solving this problem is through R&D by learning it so that it is capable of modeling effective, integrated handling systems, or a useful pattern for solving problems. The potential and issues expressed in a study should be with empirical data. Data about potential and difficulties should not be sought by themselves. Still, it can also be based on other people's research reports as well as from documentation of activity reports originating from individuals or certain agencies that are always up to date.

2. Collecting information
Approving potentials and problems factually and up to date, the next step is to receive a variety of information and literature studies that can be used as a material to plan to ensure the product to address this problem. This study aims to find concepts and theoretical foundations that can strengthen a product, especially concerning educational outcomes, such as program-shaped products, models, systems, software, approaches, etc. On the other party through this literature review will examine the scope of a product, the breadth of use, supporting conditions so that the product can optimally, as well as its limitations and benefits. Literature studies are also needed to determine the most appropriate measures in developing the product.

3. Product Design
The existing product of this R&D study has a lot of types. One of the goals is to generate a new system of work. With the system, it should be made a new design work based on the assessment of the old work system, so that there can be weaknesses to the system. Besides, research needs to be done to other units that are considered to be a sound work system. Besides, it should be done with the assessment of cutting-edge references related to the modern working system, along with a good indicator of the working system. The end result of this activity is usually a new product design that has been completed with specifications. This design is still hypothetic, because its effectiveness is still not proven, and is only known after passing tests. Product design must be realized in the form of an image or chart, so it can be used as a handle to assess and make it and will make it easier for others to understand it.

4. Design validation
Design validation is an activity process aimed at assessing whether the design of the product, in which case the new working system is rationally more effective than the old one or not. It is said to be rational because validation at this stage is still based on logical thinking, not yet based on the fact of the field. Product validation can be carried out by presenting some experts or experienced experts to provide an assessment of the new product that was designed. Each expert is asked to give the value of the new design so that the next step can be known for its strengths and weaknesses. Design validation can be executed on a discussion forum. Before discussing, researchers presented the research process until found the design, along with its excellence.

5. Design Improvements
Once the product design is finished, it is validated through discussions with experts and other experts. Then it can be known his weaknesses. The weakness was then tried to be reduced by the way to improve the design. The task of improving the design is the researcher who will produce the product.

6. Product Trial
The design of the products that have been made can not be immediately tested first. However, it must be made in advance to produce products, and that product is tested. Testing can be Dilaksankan through experiments, comparing the effectiveness and efficiency of the old working system with the new working system.

7. Product Revision
Product testing of the limited samples could indicate that the performance of the new work system turned out to be better when compared to the old system. The difference is very significant so that the new system of work can be applied or enforced.

8. Trial usage.
After testing for a successful product, and there may be a less important revision, the next step is that the new working system is enforced or applied to real conditions for a wide scope. In the operation of the new work system, it remains to be assessed barriers or shortcomings that arise for further repairs.

9. Final Product Revisions
There are advantages and disadvantages to reviewing a product if, in the repair, it has a real condition. In testing the use of the product, researchers recommend that product makers as researchers always evaluate how the product is done in this case is the business system.

10. Dissemination and implementation
In the stages of the manufacture of the product in bulk will be executed if the tested product can be produced effectively and is worth mass-produced. As an example of making machines that can convert waste into useful materials, the mass will be produced when taking feasibility studies both from the economic, technological, and environmental aspects. Entrepreneurs and researchers must work together to produce a product.

5. Result and discussion

In this research, data were obtained from a questionnaire that was distributed to 70 respondents among students Islamic religious education in UIN Maulana Malik Ibrahim Malang being the object of research.

Development trials cover Three steps of expert testing, limited trials, and a more extensive trial. In expert tests involved experts in the development of the Neural Network-based Fuzzy Topsis optimization application product applied to the expert systems of competency application detection and learning achievement by building Fuzzy Topsis structures Neural Network-based networks. The development of the method is emphasized on the optimization of the Fuzzy TOPSIS based Neural Network on the expert system of detection of core competencies, learning factors, and student learning achievements.

Table 1. Instrument Research

Code	**Core Competencies Academic Characters**	**Level of Practices**					**Level of Importance**				
H	**Honesty**	1	2	3	4	5	1	2	3	4	5
H-1	Telling what I can do and can not to group member in a project.										
H-2	Admit friends' strength in class activities.										
H-3	Confessing my weaknesses to my academic supervisors										
H-4	Telling true resources in oral and writing presentation										
H-5	Controlling myself for not to present and report a fictive data										
H-6	Copying and pasting to work on my assignments										
H-7	Pretending to understand when lecturers explain a topic of material.										
H-8	Giving appraisal to friends thought it not like as it is.										
I	**Appreciating**										
I-1	Honouring the improvement of a friend in a lesson.										
I-2	Listening to friend who is asking questions or giving an idea.										
I-3	Paying attention to every words of friends' presentation										
I-4	Respecting friends with low achievement										
I-5	Encouraging less active friend to be more active.										
I-6	Prioritizing harmony in giving different ideas for the aim of seeking agreement by using unhatred words.										
I-7	Giving appraisal to friends' effort and work.										
J.	**Tolerance**										
J-1	Appreciating differences of ideas of friends who are different from themselves										
J-2	Appreciating the attitude of others who are different from myself										
J-3	Accepting the different ways of a group member in presenting and asking questions.										
J-4	Appreciating the different ways of class members in completing assignment										
J-5	Accepting diversity in a group, for instance difference gender, academic competence, race, religion and interest										
K.	**Discipline**										
K-1	Following academic rules and regulations at my faculty										
K-2	Coming to a class before the lecture begin.										
K-3	Completing and submitting my assignment by the deadline										
K-4	Organizing my learning activities daily.										
K-5	Scheduling, timing and prioritizing my learning activities.										
K-6	Targeting 70% and above to obtain my target of learning output										
K-7	Following rules set by classroom agreement or lecturer in learning activities										
K-8	Following the template, style or format given by lecturer in completing an assignment										
L	**Patient (SABAR)**										
L-1	Devoting myself to achieve my goal of learning										
L-2	Willing to hear long explanation and argumant from a friend.										
L-3	Accepting the final result though it is quite disappointing										
L-4	Controlling my emotion in debating or discussion.										
L-5	Staying motivated though I get unexpected result of my learning										
L-6	Controlling my emotion when my ideas against or rejected strongly by others										
L-7	Staying in an effort though I failed many times until I obtain a result.										
L-8	Making myself enjoy under a group leader or lecturer pressure in a task.										
M.	**Confident**										
M-1	Pushing down my nervousesness when I am trying to perform or present. (e.g assignment presentation).										
M-2	Encouraging myself while I am presenting my assignment										

Code	**Core Competencies Academic Characters**	**Level of Practices**					**Level of Importance**				
M-3	Being confident to ask question or share my ideas without afraid by making mistakes.										
M-4	Encouraging myself to participate more in classroom activities										
M-5	Encouraging myself to be more confident to perform in the classroom.										
M-6	Assuring myself on my own ability in completing a task and assignment.										
N.	**Responsible**										
N-1	Completing my own part as group member in group project and discussion										
N-2	Totally involving my own in group discussion.										
N-3	Taking a part as moderator in classroom discussion.										
N-4	Checking some errors and mistakes by my own..										
N-5	Revising my report, task or assignment by myself as suggested by lecturers.										
N-6	Taking a role of group leader in group work and discussion										
N-7	Working and completing individual assignment by myself.										

The Fuzzy TOPSIS Algorithm is a troubleshooting solution with process sequencing to get the value of a user's preference as a final value to get a ranking of all the alternatives and criteria that have been calculated. There are several working steps of TOPSIS:

A. Create a normalized decision matrix

B. Create an ideal definite solution matrix and an ideal negative solution

C. Determine the model of the perfect positive answer and the ideal negative solution

D. Determines the distance between the values of each alternative with the matrix of the ideal positive solution and the ideal negative matrix solution

E. Specifying the preference value for each alternative

Pengujian aplikasi ditunjukkan seperti pada gambar berikut ini.

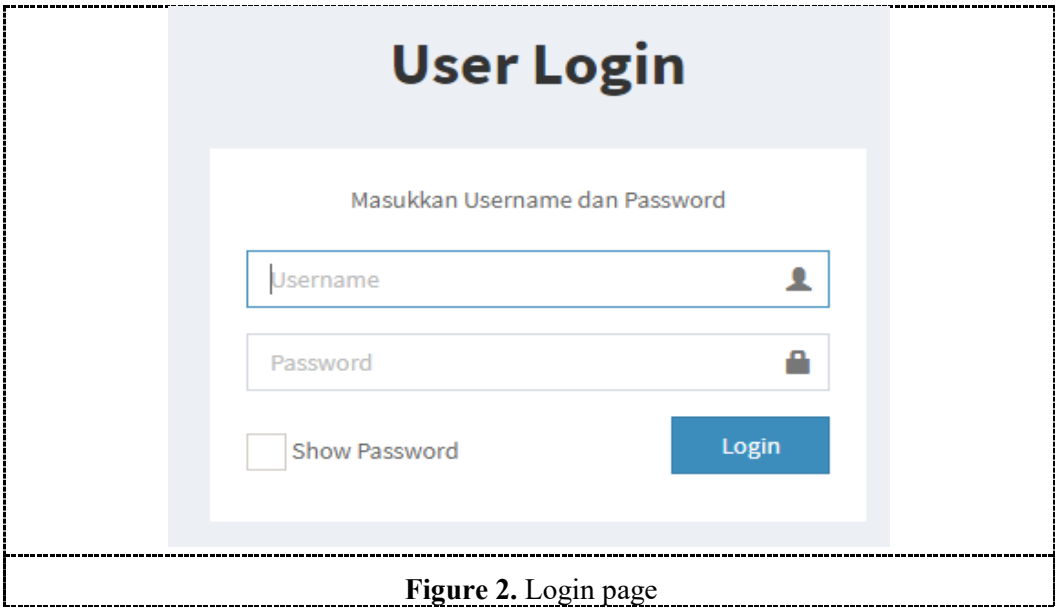

Figure 2. Login page

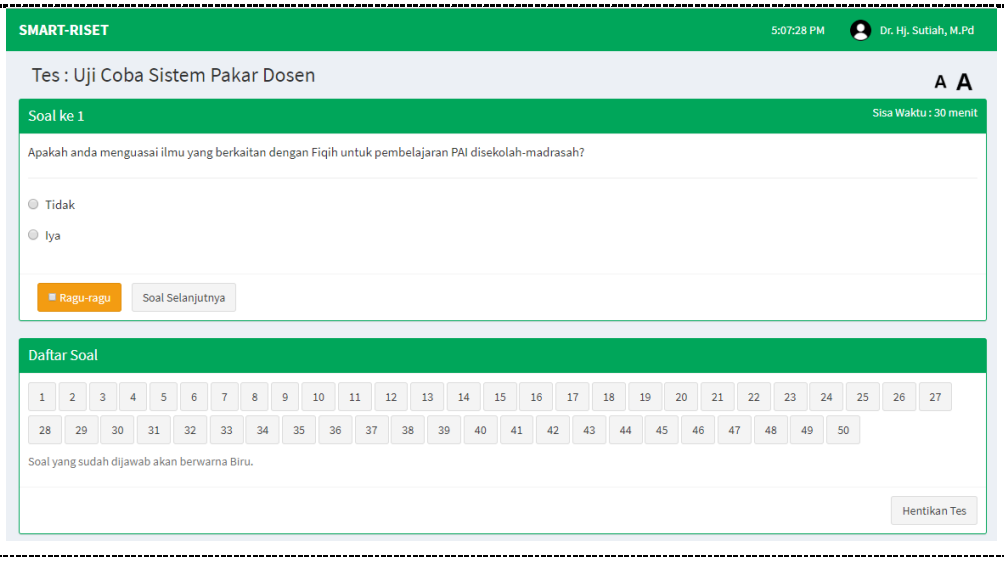

Figure 3. Expert Testing System

6. Conclusion

On the results of the implementation of several trials conducted on the application of expert systems in enhancing core competencies and detecting student achievement using the Fuzzy TOPSIS method at the Maulana Malik Ibrahim State Islamic University of Malang, it can be concluded that the resulting level of use of fuzzy TOPSIS achieves better results.

7. References

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