COURSE GRADE CALCULATION USING FUZZY LOGIC (CGCFL)

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ABSTRACT

Grade Calculation using Fuzzy Logic System is a system that developed to calculate the final grade of Data Structure and Algorithms student's more accurate and valuable result. Nowadays, the calculation of student grade for data structure subject based on three categories which are cognitive, psychomotor and affective. However, in the current scenario, the final grade not considered at all on the categories. Example of the current situation is if the students get low mark in psychomotor, however the others categories student get excellent, the final result still show that the student pass the course. To produce high quality of graduate, these three categories must be considered.

Because of this situation, this system had been developed by implement new concept using fuzzy logic and use Mamdani inferences to calculate the final grade student accurately. After done the development and implementation process, the result show that the system can produces almost 90 % accurate value. This is because the new techniques of defuzzification had been implemented which are center of gravity (COG) and mean of maximum (MOM). However, the problem is there are some value that no really accurate. This happens because of more techniques need to be used. This system is better than manual system because it calculates all the value automatically and the three categories are being considered.

ABSTRAK

'Fuzzy Logic' merupakan salah satu teknik di dalam 'Artificial Intelligence' di mana ianya semakin meluas penggunaanya di dalam pembangunan sesuatu sistem hari ini. 'Course Grade Calculation using Fuzzy Logic System' adalah satu system yang dibangunkan untuk mengira gred markah bagi pelajar yang mengambil subjek 'Data Structure and Algorithm' untuk menghasilkan keputusan yang tepat dan logik Pada masa ini, pengiraan nilai pelajar untuk mata pelajaran 'Data STucture' berdasarkan tiga kategori iaitu kognitif, amali dan afektif. Namun, dalam senario ini, nilai akhir tidak dikira semua kategori. Contoh situasi yang dialami oleh UMP ketika ini adalah jika seseorang pelajar menerima markah yang rendah dalam amali, namun lain kategori pelajar itu mendapat markah yang tinggi, namun keputusan akhir masih menunjukkan bahawa pelajar tersebut telah lulus didalam kursus ini. Pelajar yang cemerlang seharusnye mempunyai kelulusan yang tinggi di mana ketiga-tiga kategori harus dipertimbangkan.

Setelah proses pembangunan dan pelaksanaan dilakukan, Keputusan kajian menunjukkan bahawa sistem ini mampu menghasilkan keputusan hampir 90% nilai yang tepat. Hal ini kerana teknik baru proses 'defuzzificaton' telah digunakan iaitu merupakan 'centre of gravity (COG)' dan 'mean of maximum (MOM)'. Namun begitu, masih lagi mempunyai masalah iaitu sesetengah nilai yang dihasikan adalah tidak benar-benar tepat. Hal ini terjadi kerana teknik yang lebih efektif perlu digunakan. Walaubagaimanapun, sistem ini lebih baik daripada sistem manual kerana mampu mengira nilai secara automatik dan tiga kategori di ambil kira.

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LIST OF SYMBOLS

OBE - Outcomes-Based Education
COG - Centre of Gravity
PEO - Program Education Objectives
PO - Program Outcomes
CO - Course Outcomes
CGCFL - Course Grade Calculation using Fuzzy Logic
MOM - Mean of Maximum

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Nowadays, education in Universiti Malaysia Pahang (UMP) has been facing a problem which include measuring level of how educated their student. The level of student is measured based on three categories which are cognitive, psychomotor and affective. Each subject has their own learning outcomes that apply those categories for final grade. However, in the current scenario, the student level in final grade does not comply with all those categories.

Through the development of the project, the main objective of this project is to implement Artificial Intelligence (AI) concept by using fuzzy logic techniques approach to calculate the final course grade. The intelligence of the system can be show that the system will considered all the categories to measure the student's level. Then, the objective of university to produce not just excellent also can communicate well with others is achieved.

1.2 Problem Statement

Nowadays, the calculation of student grade for data structure subject based on three categories which are cognitive, psychomotor and affective. However, the final grade not considered all of the categories. The percentages of student grade are 50% cognitive, 45% psychomotor and 5% affective. Cognitive category is covered for final and quizzes. Psychomotor category is present as a technical skill such as hands on test (HOT). Then, for affective category consist of online participation. For example, for Data Structure & Algorithm course, let said that student get zero in effective, he or she still pass in the final course grade. This happens to all of the subjects in the program. As a conclusion, the course outcomes and program outcomes for all the evaluation are not achieved.

The new concept here is to implement fuzzy logic so that all the learning outcomes must be achieved to determine the course grade of student by considered the entire categories which are cognitive, psychomotor and affective.

1.3 Objectives

The objectives of the system are:

(i) To develop a prototype to calculate the course grade by using fuzzy logic.
(ii) To implement new concept of grade course calculation which integrate all the learning outcomes categories.

1.4 Scope

The scopes of the system are:

(i) The prototype will be test for BCS1093:Data Structure & Algorithm Course

(ii) The prototype will be implement fuzzy logic concept.

(iii)The program outcomes will be category into three domains which are cognitive, psychomotor and affective.

(iv)Input and output of fuzzy logic will be categories into five fuzzy set categories which are excellent, good, average, weak and very weak.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview of Outcomes-Based Education (OBE)

Outcomes-based education (OBE) is an educational process. Outcomes-based education (OBE) is one of the methods of teaching which focuses on what student is can actually do after they are taught [1]. Directed and focussed at achieving certain specified outcomes in terms of individual student learning. Outcomes are key things student should understand and be able to do or qualities they should develop. All curriculum and teaching decisions are made based on how best to facilitate the desired outcome. The educational structures and curriculum in the Program Bachelor of Computer Science & Software Engineering are design to achieve those qualities and capabilities and they are regarded as means not end.

Outcomes-Based Education (OBE) is important in education because the desired outcome is selected first and the curriculum, instructional materials and assessment are created to support the intended outcome. The outcomes-based education had been introduced because of the deficiencies of traditional education which are provides students with a learning environment with little attention to whether or not students ever learn the material. Other than that, students are given grades and rankings compared to each other. The students become exam oriented or CGPA driven. Graduates are not

completely prepared for the workforce. Lack of emphasis on soft skills needed in jobs communication skills, interpersonal skills, analytical skills and others skills [8].

2.1.1 Theory of Outcomes-Based Education (OBE)

A recent definition of outcome-based education comes from James Towers. He wrote, "Education that is outcome-based is a learner-centered, results-oriented system founded on the belief that all individuals can learn"[1]. Towers (1996) listed four points to the OBE system that are necessary to make it work [2]:

- What the student is to learn must be clearly identified.
- The student's progress is based on demonstrated achievement.
- Multiple instructional and assessment strategies need to be available to meet the needs of each student.
- Adequate time and assistance need to be provided so that each student can reach the maximum potential.

William Spady (1994,) who is still widely regarded as OBE's leading advocate, explained outcomes-based education as focusing and organizing everything in the education system around what is essential for all students to be able to do successfully at the end of their learning experiences. This means starting with a clear picture of what is important for students to be able to do, then organizing the curriculum, instruction and assessment to make sure that learning ultimately happens [3].

William Spady and Kit Marshall wrote (1994), outcomes are clear, observable demonstrations of student learning that occur after a significant set of learning experiences. They are not values, attitudes, feelings, beliefs, activities, assignments,

goals, scores, grades, or averages, as many people believe. Typically, these demonstrations, or performances, reflect three things [1]:

- What the student knows
- What the student can actually do with what he or she knows
- The student's confidence and motivation in carrying out the demonstration.

Another theory of OBE system concept is in Wikipedia(the free encyclopedia), where it's explained that outcomes-based education (OBE) is a model of education that rejects the traditional focus on what the school provides to students, in favor of making students demonstrate that they "know and are able to do" whatever the required outcomes are. It reflects a belief that the best way for individuals and organizations to get where they're going is first to determine where they are and where they want to be then plan backwards to determine the best way to get from here to there. Outcome-based education (OBE) is a recurring education reform model. It is a student-centered learning philosophy that focuses on empirically measuring student performance, which is called outcomes [4].

Another set of outcome-based education theorists are Floyd Boschee and Mark Baron. They defined outcomes as future oriented, publicly defined, learner-centered, focused on life skills and contexts that characterized by high expectations of and for all learners, and sources from which all other educational decisions flow. Further they defined learning as facilitated carefully toward achievement of the outcomes, characterized by its appropriateness to each learner's development level, and active and experienced-based (Boschee and Baron, 1994) [1].

2.1.2 Level of Outcomes-Based Education (OBE)

There are three levels in OBE, which are program educational objectives (PEO), program outcomes (PO) and course outcomes (CO). The Figure 2.1 shows the level of OBE [5].

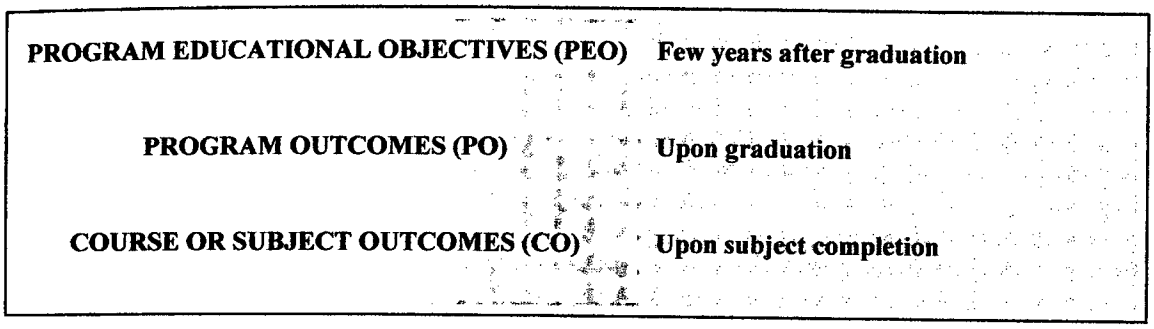

Figure 2.1: Different level of OBE [5].

Program Educational Objectives (PEO) is statements that describe the expected accomplishments of graduates during the first several years following graduation. The concept that must be always remember to create the PEO: [6]

- Should they be practitioners in the profession of the discipline?
- Should they have entered the work force prepared for entry-level jobs?
- Should they be in a graduate or professional degree program?
- Should they have passed a licensure or certification exam in the field?

Program Outcomes (PO) is focus on those abilities that are measurable at the successful end of a student's academic program [5]. Other definitions of programme outcomes are statements describing what students are expected to know and be able to perform or attain by the time of graduation, and shall [7]. These relate to the skills, cognitive, and behaviours that student acquire through the programme, and are linked to the programme educational outcomes.

Course outcomes (CO) describe what discipline faculty agrees are the most important abilities, cognitive, values, and attitudes that students should acquire as a result of successfully completing the course, regardless of where the course is taught, how it is delivered, or who teaches it. In developing course outcomes it often helps to think in terms of three domains which are [8]:

- Cognitive abilities - what does the student know?
- Psychomotor- what can the student do?
- Affective -what does the student care about?

Figure 2.2 shows the domain of course outcomes (CO) and its type [9]. In Data Structure & Algorithm course also includes the three domains and each have their percentage to evaluate the performance student in different activities. We can conclude that the cognitive is a knowledge skill, psychomotor is a technical skill and affective is a soft skill.

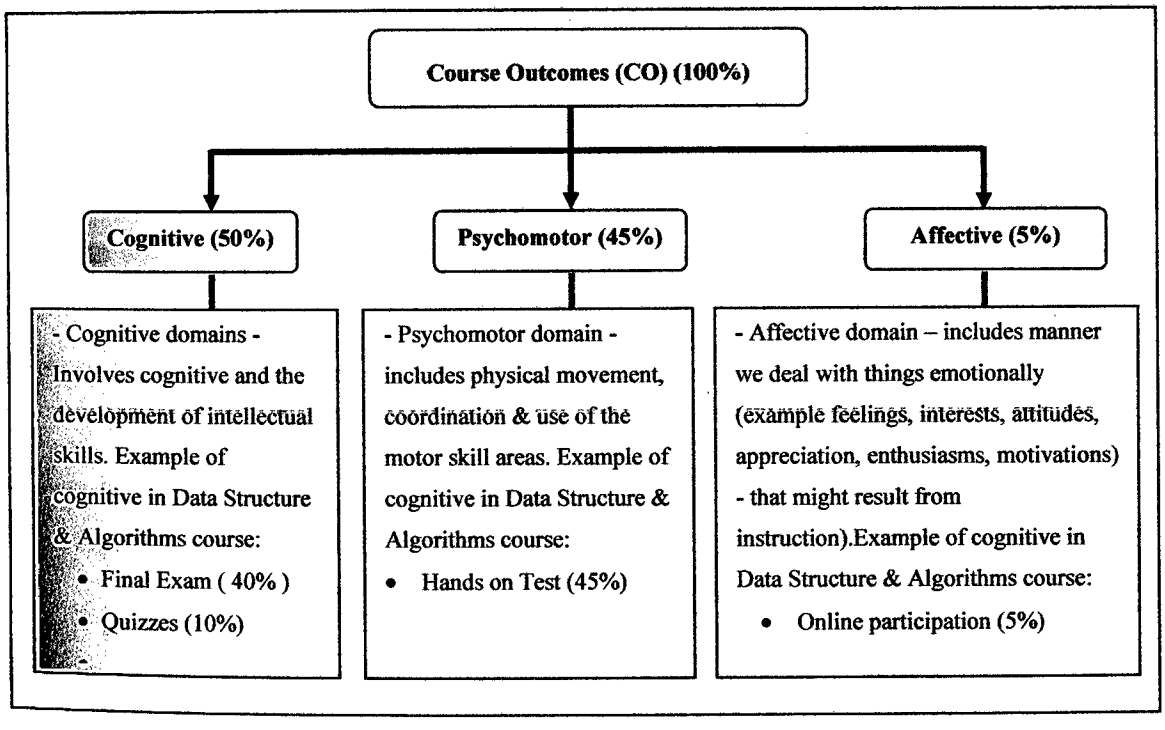

Figure 2.2: The percentages of domains for Data Structure & Algorithm course.

2.1.2.1 Program Educational Objectives (PEO) for Bachelor of Computer Science (Software Engineering)

Bachelor of Computer Science (Software Engineering) program has stated the program educational objectives that are consistent with the vision and mission of the Universiti Malaysia Pahang as follows [10]:

PEO1 80% of our graduates should be employed in national, multinational or government organizations within 5 years in ICT related fields.

PEO2 60% of our graduates will be promoted to a senior level within 5 years.

2.1.2.2 Program Outcomes (PO) for Bachelor of Computer Science (Software Engineering)

Performance skills and abilities are emphasized throughout the three year and half undergraduate program in order to prepare students to be successful engineers and to meet the university's program outcomes. Upon completion of the Bachelor of the Computer Science (Software Engineering) program at Universiti Malaysia Pahang, graduate will be able to [10]:

PO1 Able to demonstrate cognitive and understanding o the theory and principles of Computer Science specializing in Software Engineering.

PO2 Able to apply appropriate techniques, skills and tools in Computer Science practices specializing in Software Engineering

PO3 Able to identify problems and produce innovative solutions that comply with principles of Computer Science practices specializing in Software Engineering