



**Faculty of Information and Communication Technology**

**DISCOVERING STUDENT LEARNING STYLES IN ENGINEERING  
MATHEMATICS AT POLITEKNIK MERLIMAU USING NEURAL  
NETWORK TECHNIQUES**

**Asmarizan Binti Mat Esa**

**Master of Computer Science (Software Engineering and Intelligence)**

**2015**

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MATHEMATICS AT POLITEKNIK MERLIMAU USING NEURAL NETWORK  
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**ASMARIZAN BINTI MAT ESA**

**A project submitted in fulfillment of the requirements for the degree of Master of  
Computer Science (Software Engineering and Intelligence)**

**Faculty of Information and Communication Technology**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2015**

## DECLARATION

I declare that this project entitled “Discovering Student Learning Styles in Engineering Mathematics at Politeknik Merlimau Using Neural Network Techniques” is the result of my own research except as cited in the references. The project has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....

Name : .....

Date : .....

## **APPROVAL**

I hereby declare that I have read this dissertation/report and in my opinion, this dissertation/report is sufficient in terms of scope and quality as a partial fulfillment of Master of Computer Science (Software Engineering and Intelligent).

Signature : .....

Supervisor Name : .....

Date : .....

## **DEDICATION**

*To my beloved husband “Shahrul Zaman Bin Zakaria”, my mother “Zizah Binti Mamat”, my late father “Mat Esa Bin Wook” (17.04.1953 – 24.4.2015), all my siblings, who supported me for each step of the way and give me passion also strength with their smile.*

## ABSTRACT

The identification of students' learning style in learning mathematics is important for educators in choosing an effective teaching approach/methodology. Students from different field of studies to complete were asked the Index Learning Styles questionnaire to identify the student's learning style of learning DBM1013 - Engineering Mathematics. This technique is used to consider their learning styles and how to improve students' performance in learning DBM1013 – Engineering, Mathematics, the questionnaires were evaluated to identify the best learning styles used by students in learning Engineering Mathematics. However, the problem with this method is the time spent by students in answering questions and the accuracy of the results obtained. If questionnaires are too long, students tend to choose both answers arbitrarily instead of thinking about the result of the student's learning style observed through analysis. This research identified the classification of students learning styles based on the Felder Silverman Learning dimension. Four learning dimension has been classified by using backpropagation neural networks. The algorithm has been run on training, validation and testing, training process data and 20 neurons. The result shows that the neural network is able to identify the students' learning styles according to the dimension with satisfying result.

## ABSTRAK

*Mengenal pasti Gaya Pembelajaran Pelajar semasa sesi pembelajaran matematik adalah salah satu kaedah yang penting untuk para pendidik menentukan cara yang sesuai bagaimana untuk mengajar para pelajar mereka. Penyelidik akan meminta pelajar dalam bidang pengajian yang berbeza untuk menjawab soal selidik Gaya Indeks Pembelajaran bagi mengenal pasti gaya pembelajaran pelajar dalam pembelajaran DBM1013 - Matematik Kejuruteraan. Teknik yang digunakan adalah bagi mengingatkan pembelajaran dan bagaimana untuk meningkatkan prestasi pelajar dalam pembelajaran DBM1013 - Kejuruteraan Matematik, soal selidik ini akan dinilai untuk mengetahui gaya pembelajaran terbaik yang digunakan oleh pelajar dalam pembelajaran Matematik Kejuruteraan. Walau bagaimanapun, masalah yang dihadapi dengan menggunakan kaedah ini adalah masa yang diambil oleh pelajar menghabiskan menjawab soalan dan ketepatan keputusan yang diperolehi. Soalan soal selidik yang terlalu panjang, pelajar cenderung untuk memilih kedua-dua jawapan secara sewenang-wenangnya dan bukan memikirkan kesan gaya pembelajaran pelajar yang dapat dilihat melalui analisis. Kajian ini adalah untuk mengenal pasti klasifikasi pelajar gaya pembelajaran berdasarkan dimensi Pembelajaran Felder Silverman. Dimensi Gaya Pembelajaran telah dikelaskan kepada Empat pembelajaran dengan menggunakan rangkaian neural rambatan balik. Algoritma yang telah dijalankan pada latihan, pengesahan dan latihan ujian proses data dan 20 neuron. Hasil kajian menunjukkan bahawa rangkaian neural berupaya untuk mengenal pasti gaya pembelajaran pelajar mengikut dimensi dengan keputusan yang memuaskan.*

## ACKNOWLEDGEMENT

Alhamdulillah, Allah Ta'ala has given me a gift to this thesis, which may be a religious charity to me personally.

First and foremost, I would like to take this opportunity to express my sincere acknowledgement to my honorable supervisor; Dr. Asmala Bin Ahmad for this thesis would not have been possible without valuable help, support and patience from him. May Allah Ta'ala reward him with a reply that much better than what all he has done. It could not have been possible to write this thesis without the help and support of the kind people around me, to only some of whom it is possible to give particular mention here. Not forgotten the entire panel who had given me some research challenge to improve my study.

Particularly, I thanks sincerely to my Head of Department, Cik Hj Intanku Salwa binti Shamsuddin, and to all colleagues and others who have provided assistance at every occasion of the study.

I convey my deepest gratitude and sincere love of my blessed parents, Mat Esa Bin Wook and Zizah Binti Mamat, to my beloved sisters and brothers; Asmadi, Asmadera, Asmaliza, Asmahani, Nur Asmihan, Azmi, Anuar and Putra Faisal for their uncountable support, prayers and encouragement. To my beloved husband, Shahrul Zaman Bin Zakaria thanks you for helping and supports. Ya Allah, please I hope you reward them in the world and the hereafter. Lastly, thank you to everyone who had been associated with the crucial parts of realization of this project.

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## **CHAPTER 1**

### **INTRODUCTION**

#### **1.0 Introduction**

In Malaysia, polytechnics established by Ministry of Education Malaysia (MOE) offer programs at diploma, advanced diploma and recently, bachelor degree level. The diploma programs are offered at 33 polytechnics under, however the advanced diploma and bachelor degree are only offered at selected polytechnics.

In order to enroll the program offered by a polytechnic, prospective students are required to fill in the online form from ‘Unit Pusat Universiti’ (UPU) website managed by Bahagian Pengurusan Kemasukan Pelajar (BPKP), a department under the ministry. Now, SPM result is directly linked to the UPU website, therefore students no longer are required to fill in their result and also the basic student’s information. This on-line system automatically decides a course that suits the student.

Mathematics is one of the subjects that a student needs to pass during SPM level in order to be qualified to apply for engineering courses at polytechnics. During diploma studies, engineering diploma students are required to enroll three engineering mathematics subjects.

#### **1.1 Background of the Study**

Generally, polytechnics in Malaysia were formed to produce graduates at semi-professional level in the field of engineering, commercial, hospitality, ICT and services, and provide an alternative route to higher education, for example public or private

institutions for post-secondary students in Sijil Pelajaran Malaysia and Sijil Pelajaran Malaysia (Vokasional) and certificates from polytechnic and college community graduates. Polytechnic was established in 1969 from the Colombo Plan wherein the first polytechnic is Polytechnic Ungku Omar, located in Ipoh, Perak. Polytechnic education is monitored by the Cabinet Committee through several agenda the Implementation of Education Policy (1979), the Cabinet Committee on Training (1991) and the National Industrial Master Plan (1985-1995).

The vision of the polytechnic is “To be Malaysia’s main provider of innovative human capital through transformational education and training for global workforce by 2015”, and its mission “Breaking boundaries for the creation of transformative and creative learning environment for an innovation-led economy”. For prospective post SPM students, the application requirements for the diploma program are, firstly candidate must be a Malaysian citizen and passed SPM or equivalent examination with the minimum conditions: Passed Bahasa Melayu and English, get three (3) credits for the following subjects including; Mathematics or Additional Mathematics one (1) related subjects Science / Technology / Vocational one (1) other subjects. The duration for diploma in Marine Engineering is three and half years (seven semesters), two years (four semesters) for diploma in Secretarial Science while three years (six semesters) for the rest of the diploma course. Student intake occurs twice per year, which is in June and December.

These polytechnics practice a systematic teaching and learning in which students need to follow in order to complete the courses they undertake successfully. These include preparation before and revision after attending a class. Since student as a learner has become the centre of teaching, knowledge of the learner and his learning style should be considered. Learners have become complex individuals that are capable of learning on their own; therefore there should be change in of teaching methodology/approach.

Assessment done by students are based on a combination of coursework and final examination at the end of the semester. All students are required to undergo an industrial training for one semester. During industrial training, students are exposed to the realities and demands of real working environments and conditions.

During the first semester, it is compulsory for engineering students to take DBM1013 – Engineering Mathematics course. Engineering Mathematics introduces students to the basic algebra including performing partial fractions. It also exposes the concepts of trigonometry, introduces the theory of the complex number, matrices method to solve simultaneous equations as well as introduce students to the concept of vector and scalar.

Neural Network is an information processing paradigm that is inspired from how the biological nervous system works, specifically how the brain processes information that are received through the senses in the human body. However, this project will focus more on discovering learning styles in Engineering Mathematics. Some students have verbal learning styles which are insufficient to cover other, learning styles (Nor Bahiah & Siti Mariyam 2008). The learning styles of their Mathematics performance and achievement level are significant to students learning styles (Jong Li & Ling Siew 2010). Learning styles of each student are different based on their behavior, intention; background and level of understanding that are related to their field study.

## **1.2 Problem Statement**

To ensure students achievement in their studies, it is necessary for lecturers in polytechnic and other higher education institutions to identify students' learning styles. The problem statements of this research are listed as below:

1. The Student don't know how to manage their time in self-learning and their learning styles. It will be helpful for them to succeed in their studies.
2. Students need to pass DBM1013 - Engineering Mathematics 1 subject; this is a problem for students who don't take Additional Mathematics during SPM, which is a combination of Engineering Mathematics Modern Mathematics, Additional Mathematics, Calculus and Statistic.

### **1.3 Research Question**

This study attempts to answer the following research questions:

- i. How can Artificial Neural Network (ANN) Techniques be used to identify students learning styles?
- ii. What are the variable that needs to be considered?
- iii. How good is the performance of ANN in identifying student learning styles?

### **1.4 Research Objective**

1. To investigate approaches to identify learning styles among the Engineering Mathematics students in polytechnic.
2. To propose a technique for analyzing and identifying student learning styles using ANN.
3. To evaluate the performance of the technique.

## **1.5 Research scope and Limitation**

This research takes into consideration the ethical and privacy issues in information and person involved. To maintain the privacy, the questionnaire given does not require the respondent's, name to this allow respondents to feel comfortable in answering the questionnaire and this attain a more accurate result.

The scopes of the study are:

1. Using questionnaire to get information about learning style in order.
2. Using the neural network technique to discover the learning styles of students in order to get the required result and accuracy.
3. Using the result of the students' learning styles to compare with the result of the end of semester examination for DBM1013 - Engineering Mathematics subject in Semester 1.
4. All experiments are conducted by using the MATLAB R2010a

## **1.6 Significant and Research Contribution**

This study is hoped to identify learning styles among the students taking DBM1013 - Engineering Mathematics 1 based on the questionnaire. The groups of students involved have their own learning style, which are:

1. Dependent: student that cannot studies on their own. These students can't learn independently in understanding what they learn. They need a lecturer or mentor to make them really understand the lesson. If not, they are not motivated to continue their studies.
2. Independent: student can study by using their own styles and can explore the knowledge, for example, they used ICT technology in learning.

Thus, this study is evaluated with comparison among Index Learning Styles, Artificial Neural Network (ANN) with Linear Regression using R Code to match the result.

## **1.7 Organization of the Thesis**

This thesis consists of five chapters that are structured as follows:

### **Chapter 1: Introduction**

Chapter 1 describes the introduction part. The background of the study is briefly explained in this chapter, followed by problem statement, research question, research objectives, scope and limitation and project significance.

### **Chapter 2: Literature Review**

Chapter 2 discusses the literature review part. In this chapter, the states of the art that are related to the learning styles model were explained thoroughly.

### **Chapter 3: Research Methodology**

Chapter 3 describes the methodology of this study. This chapter discussed about the methodology that have been chosen to achieve the research objectives. The type of research method, research design, proposed methodology, and proposed Artificial Neural Network technique are explained in details.

### **Chapter 4: Data Analysis Result**

Chapter 4 described the result and analysis of the newly discovered approach in identifying learning styles. In this chapter 4, the student learning styles dimensions are

classified. These data samples will analysis with Index Learning Styles Evaluator, ANN and Linear Regression by using R code.

## **Chapter 5: Conclusion and Future Work**

Chapter 5 discussed the conclusion and summary of this study. It also describes the result obtained in the previous. These sections provide a conclusion; summarize all the content of this report, research contribution and also provides some suggestion and recommendation for future work.

### **1.8 Summary of Chapter**

These chapters explain the overall overview of the project. The background of the study, problems, research questions and objectives and project significance of the discovering learning styles for DBM1013 – Engineering Mathematics 1 students. The literature review is related to Learning styles and using Neural Network is explained.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.0 Introduction**

The purpose of this chapter is to review the current literature related to the study. There are enormous amount of literature on learning styles, however this chapter focused on the most relevant ones in order to fulfill the aim of this study. The first section starts with a general review of Learning Styles Model. The section continues by reviewing the existing literature in terms of Neural Network (NN) and its collaboration with Genetic Algorithm (GA), the Bayesian Network and Optimization. The last section discussed the Neural Network technique to be implemented in this study.

#### **2.1 Learning Styles Model**

In the learning process, learning styles commonly used are independent and dependent style and related to the learning styles dimension. An example of the former can be seen in the scenario where some students can learn Mathematics using a book or reference to do an exercise, while an example of the latter is the scenario where some students is fully based on the teachers who taught them. In learning Mathematics, students must do more exercise to get a better understanding on this subject. Learning Style (LS) can be defined as the way that person collects, organize, processes and used the information in their life or study (Carmona et al. 2008). In other words, learning style is the cognitive, affective and psychological characteristics on how students interact and respond to the learning environment. Adaptive Learning Style is an important factor in learning and