INVESTIGATING TEACHER'S INTEGRITY THROUGH ASSOCIATION RULE MINING

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2012

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DATE: 28 May 2015

ACKNOWLEDGEMENT

The authors wish to express their gratitude to Universiti Utara Malaysia and School of Computing, College of Arts and Sciences (CAS) for financing the research (LEADS Grants Scheme) and to facilitating the monitoring of the research till completion.

ABSTRACT

The selection of teachers to attend trainings is currently done randomly, by rotation and not based on their work performance. This poses a problem in selecting the right teacher to attend the right course. Up until now, there is no intelligent model to assist the school management to determine the integrity level of teacher and assign them to the right training program. Thus, this study investigates the integrity traits of teacher using association rule technique with an aim, which can assist the school management to organize a training related to teachers' integrity performance and to avoid sending the wrong teacher for the training. A dataset of Trainees Integrity Dataset representing 1500 secondary school teachers in Langkawi Island, Malaysia in the year 2009 were pre-processed and mined using apriori. Mining knowledge was analyzed based on demographic and integrity trait of teacher. The finding indicates that adaptability and stability are the weakest integrity trait among teachers. Teachers from the age group of 26 - 30 years are found to have lower integrity performance. However, other demographic factor such as gender, race, and grade position of teachers were not able to reflect their low integrity level in this study. Finally, this study produces a component of trainee selection module which can be used as guideline for school management to propose suitable training programs for teacher to improve their integrity mainly on adaptability and stability traits.

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

ABBREVIATION AND ACRONYMS

MOE	Malaysia of Education
BFM	Big Five Model
TID	Teacher Integrity Dataset
AR	Associate Rule
PIM	Personality Identification Module

CHAPTER 1

INTRODUCTION

1.1 Background Study

Integrity is a vital trait and is viewed as the quality of having an intuitive sense of honesty and truthfulness of a human in completing task. Human beings will be more accountable and responsible towards his job if integrity is high. It is the key of success to everyone, and many organizations have benefited an enormous performance increase when their employees own good integrity behavior. As stated in (Christensen, 2009), nothing can work without the presence of integrity. In relation to integrity, it is stressed out that the integrity among teachers is critically important and sometimes the solution towards integrity issues is difficult to be answered. This includes teachers who play a very important role to nation. They are responsible to develop valuable citizens and educate students with a high-quality education. To teach students mainly at the young age is not an easy job. Therefore, teachers must have high integrity, and they must establish integrity within the school to accomplish the goal. Without the presence of integrity, teachers will definitely fail to do it. Besides that, they also need to be very understanding and show their understanding to the students' behavior (Thornton, 2004). High quality teaching is essential to improving student outcomes and reducing gaps in student achievement. Stated by (Starling, 2009), an effective teacher is capable of inspiring greater learning gains in their students compared to a teacher with low teaching quality. Those traits have a strong

relationship with teacher's integrity. With the high capacity of integrity, teacher will be motivated to educate student and help the country to develop human capital. It will not only benefit the students and country, but also the teacher itself in providing them with meaningful appraisal, encourage professional learning and growth.

1.2 Problem Statement

To achieve or maintain high level of integrity among teachers, the Ministry of Education (MoE) has arranged many programs for teacher's development through training, work-shop, and seminar. Currently, the training program is randomly organized to fit the yearly calendar without considering the suitability of candidate for the training program. Candidates for a program usually are done randomly, or rotationally. As a result, many trainees are not selected based on the needs of the training programs. In short, it can be said that there is a mismatch between trainees and training programs. This happens because there is no systematic method of trainee selection.

As a result, this will create difficulties for the school management to identify problematic teachers and sending the wrong ones to attend the training. If the requirement of training program is mismatched with the trainee, there is a high possibility that the objective of the training cannot be achieved. Teachers who possess such negative attitudes would not be suitable for an integrity program. If they were selected randomly, there would be a mismatch of supply and demand of needs which would cause failure in the integrity training programs to achieve their goals. According to several studies, selecting a wrong person can increase a cost between

30% and 200% of a person's annual salary. If a role worth $70,000 a year is filled with the wrong candidate, it could end up costing between $21,000 and $140,000 – a loss most businesses cannot afford to make (Dowding, 2011). Even though there is a keen action from the government to raise the teacher's integrity, it appears to be a number of reports that some teachers are unable to perform their tasks efficiently when they are having a problem with students and also some of them might involve in crimes (Ahmad, 2010; Hassan, 2010).

1.3 Objectives of Research

The main objective of the study is to investigate teacher level of integrity using association mining rule. To achieve this objective, three specific objectives are fixed:

i) To identify the level of integrity traits among teachers

ii) To identify the weakest integrity traits and the strongest integrity traits level among teachers

iii) To design the components of trainee selection module using intelligent technique

1.4 Scope of Research

Data was collected from the secondary school teachers in Langkawi Island, Malaysia in the year 2009. The Big Five Model (Barrick & Mount, 1991) was used as the basis for identifying integrity traits.

1.5 Significance of the Research

The school management can organize motivational training based on levels of integrity of teachers. Besides that, the findings can be used as a guideline to select suitable candidates.

1.6 Report Organization

This research report consists of five chapters. Chapter 1 discusses the background and problem statement of the study. The research objectives and scope are also identified in this chapter. Chapter 2 describes related works on the study, while Chapter 3 presents the methodology of the research. Meanwhile, Chapter 4 discusses on analysis part which are based on the objectives of this study. Chapter 5 presents the conclusion of the research and recommendation for future work.

CHAPTER 2

LITERATURE REVIEW

This chapter presents the background of the study. The concept of integrity in teaching and learning is discussed in Section 2.1. It is followed by the needs of teacher's integrity in Section 2.2. In Section 2.3, an association rule and Apriori algorithm are discussed. This is followed by an explanation on the Big Five Model, a model to measure integrity in Section 2.4. Section 2.5 elaborates data mining as the data analysis tool, and previous works on data mining application in education. Summary are in Section 2.6.

2.1 The Concept of Integrity in Teaching and Learning

There are two meanings of the word *integrity* which are related to signify *wholeness* or *completeness* used by Sir Thomas More in 1633 and the other meaning is that of *soundness of moral principle* and, specifically, uprightness, honesty or sincerity. However, the most common meaning of the word today seems to me to be the one emphasizing moral principle. The two meanings of the word integrity interact and shed light each on the other. Integrity may have a moral and ethical connotation not only in relation to persons. So, for example, if we turn to the concept of academic integrity in a school context, the issues that arise certainly include whether certain

individuals are honest, or whether students cheat or plagiarize, but also there are broader issues, which include integrity in intellectual enquiry, integrity in teaching.

Now the meaning of integrity as “moral” or “ethical” finds a place in a serious notion of intellectual enquiry, arising from the fact that the enquirer should be prepared to accept the results of the enquiry regardless of his or her own personal interest in the outcome, submitting himself or herself to a larger whole and a wider judgment. For, just as ethical behavior may require us to override our personal convenience and submit ourselves to a wider ethical reality, so an aim to enquire or attain knowledge may require us to submit ourselves to a wider *intellectual* reality, and integrity in the ethical sense may arise by submitting ourselves to this reality. Regarding to Popper (1983), it can be said that the search for “pure knowledge” leads to integration and integrity conceived of as wholeness, whereas applied knowledge proceeds by ever greater specialization, perhaps even by fragmentation.

Integrity in teaching will endeavor to promote this integrity of enquiry and knowledge in which both students and teacher participate. This requires a genuine commitment of the teacher to those ideals, for students are experts in detecting feigned or insincere attitudes. The single most important factor here, in my view, is respect for the student, and one way of concretely realizing this is by making learning and teaching a *mutual* task. By making learning a mutual task, the student may come to develop an inner confidence and come to feel that he or she has something unique and individual to bring to that task. The teacher should try to enable the student to maintain a balance between inner confidence and a feeling of being challenged, with the aim, over time and as required, of making the student able to accept intellectual challenge and

independence with confidence, even with resolution. In other words, integrity in teaching is to an extent an endeavor to create a unity and balance in the student's learning and knowledge (Nillsen, 2004). Thus, the teacher interested in promoting integrity in the sense described here has many options, and some specific ones have been indicated. But perhaps the most important requirement is for the teacher to develop a sense of integrity in learning and knowledge as a lifetime project, for only then will the teacher find ways of promoting integrity in the very varied circumstances that the different teachers face.

2.2 Teachers' Integrity

Finding a teacher with high integrity characteristic is not easy since there is no agreement on what makes a teacher have a high quality attitude in school. Such criteria like the experiences that the teacher has, the education level, and the performances achieved by their students can be used to measure his integrity. Besides that, the integrity test such as the Big Five Model (Howard & Howard, 2001) and personality test (Daniel, 2009) also can be a guideline to measure the level of teacher's integrity. High quality teaching is essential to improving student outcomes and reducing gaps in student achievement. In school, teachers must uphold the highest integrity and be a good role models to their students at all times. Their responsibility towards students are not limited during school hours but continued after the class end. Teachers are the nearest people who are examples for students other than their parents. As an idol for students, teachers need to be equipped with a good package of moral quality. For the reason to attract students to behave nicely, teachers must have a quality mind and good attitude to impress students. They need to be familiar with the

students as well as the school community to be able to successfully educate students. Good quality teachers must be able to target and plan how to manage their students to become good quality students (Baker, 1990; Nillsen, 2004).

2.3 Association Rule (AR)

```
Input: database of transactions (D); the minimum support count
threshold (min sup)
Output: frequent itemsets in D (L)

(1) L1 = find_frequent_1-itemsets(D);
(2) for (k = 2;Lk-1 ≠ Ø;k++){
(3)   Ck = apriori_gen (Lk-1);
(4)   for each transaction t ∈ D { // scan D for counts
(5)         Ct = subset (Ck, t); // get the subsets of t that
are candidates
(6)         for each candidate c∈Ct
(7)               c.count++;
(8)   }
(9)   Lk ={c∈Ck|c.count ≥ min_sup}
(10) }
(11) return L = ∪kLk;

Function apriori gen(Lk-1:frequent (k-1)-itemsets)
(1) for each itemset l1 ∈ Lk-1
(2)   for each itemset l2 ∈ Lk-1
(3)         if (l1[1]=l2[1])^( l1[2]= l2[2])^…^( l1[k-2]=l2[k-
2])^( l1[k-1] <             l2[k-1]) then {
(4)               c = l1▷◁l2; // join step: generate candidates
(5)               If has_infrequent_subset(c, Lk-1) then
(6)                     delete c; // prune step: remove
infrequent candidate
(7)               else add c to Ck;
(8)         }
(9) return Ck;

Procedure has infrequent subset(c: candidate k-itemset;
      Lk-1: frequent (k-1)-itemsets); // use prior knowledge
(1) for each (k-1)-subset s of c
(2)   if s∉Lk-1 then
(3) return TRUE;
```

Figure 2.1: Generating frequent item set in apriori

In this section, the basic of association rule (AR) mining is discussed. Association Rule or AR mining was first inspired by Agrawal & Srikant (1994) in apriori algorithm. The algorithm depicts in Figure 2.1 is the process of generating frequent item set in apriori (Agrawal & Srikant, 1994; Han & Kamber, 2006).

AR mining's processes begin with searching for frequent item set with user-specified minimum support and later rules are contrasted by binding the frequent item with its values and class. Strong rules are defined as rules that have confidence more than the minimum confidence threshold. Recently, AR has been used in various areas mainly when the problem need to be solved requires the identification of important relationship among variables such as the work of (Mohamad Mohsin et al., 2010b; Ma et al., 2000).

2.4 Big Five Model

Howard & Howard (2001) developed the Five Factor Model (FFM) which consists of five major personality traits to measure integrity. The major traits include need for stability, extraversion, originality, accommodation, and consolidation. FFM has been found to produce consistent results over the past years and is the basis of characterizing personality (Saulsman & Page, 2004; Barrick & Mount, 1991; Mount & Barrick, 1998). Measuring the integrity of a training candidate can help authority such as employer and training provider to identify the levels of integrity of a person. The integrity traits are list out in Table 2.1 as stated in following;

Table 2.1: Integrity Traits based on Five Factor Model

Five Factor Model (BFM)
Openness (Originality, Imagination, openness to experience) The openness of a trainee towards new experience. Human with openness is said to own more intellect, imaginative, curious, appreciative of art, and sensitive to beauty.
Conscientiousness (Will to achieve, Consolidation) A tendency to show self-discipline, act dutifully, and aim for achievement against measures or outside expectations.
Extraversion (Positive Emotionality, Sociability) Related to positive emotions and surgency. It has tendency to seek out stimulation, has engagement with the external world, always enjoy being with people, and often equipped with full of energy as well as an action-oriented individuals.
Adaptability (Agreeableness, Accommodation) Is a social harmony trait and has tendency to be compassionate and cooperative rather than suspicious and antagonistic towards others.
Need For Stability (Negative Emotionality, Neuroticism) Called as emotional instability that has relation to how a trainee respond to stress, experience negative emotions

Training programs are designed for candidates that possess a certain set of requirements. Usually the requirements are divided into several components such as certain age group, characteristics of individuals, soft skills, hard skills, knowledge, and health condition. Different training programs have different requirements and identifying what requirements are needed and scoring them would allow management to know which candidates are suitable. Thus, a mechanism to identify requirements and scoring them is needed to ensure a supply of suitable candidates. Since selection is made through top-down or bottom-up approach, these methods produced shortlisted candidates who majority does not fit for the training program's requirements. An

intelligent method could automatically select suitable candidates by matching the personality characteristics with the training program requirements.

2.5 Data Mining in Education

Data mining is a recent data analysis technique which can assist decision maker to extract hidden relationship from database (Han & Kamber, 2001). Data mining actually is a combination of machine learning, statistical analysis, modeling techniques and database technology. Thus, data mining is capable to find patterns and subtle relationships in data and infer rules that allow the prediction of future results. Data mining analysis has been applied in many domains such as business, medical, engineering, education and it has ability to provide additional guideline for future decision making (Mohsin & Abd Wahab, 2008). Recently, there have been many works in education that employs data mining as data analysis. From the literature, data mining is used as prediction and classification tools and identifying important relationship among variable. Ma *et al.* (2000) uses association rule algorithm for selection of students for remedial class using the O-level subject's results. Using the algorithm, students performing lower than the cut-off marks were recommended for the remedial classes and claimed that the predictive model based on data mining is much more precise. As predictive tool, data mining is used to predict the academic performance of student. For example, artificial neural network and a combination of clustering and decision tree classification techniques had been used for predicting and classifying students' academic performance of National Defence University of Malaysia. (Wook et al., 2009). In line with Ma *et al.* (2000), Mohamad Mohsin *et al.* (2010a) applied data mining method (association rule) to identify computer

programming characteristic that influence student performance when they learn programming in university. Besides that, there is also an effort to investigate the influence factor of student programming grade rough set (Mohamad Mohsin et al., 2010a) and clustering (Hibadullah & Norwawi, 2007). Since data mining can offer hidden knowledge which is hard to be seen through traditional data analysis, this study aims to explore integrity trait among teacher which reflect their work performance. In this study, association rule technique is selected as data mining analysis tool.

2.6 Summary

The background study aims to emphasize the literature on training program for teacher in order to increase their work performance. It is found that the right training program for teachers can be achieved by using an associate rule based on their integrity trait. This effort can be implemented through the Big Five Model as a significant model due to find a right training program with a suitable teacher.

CHAPTER 3

METHODOLOGY

This chapter presents the methodology used in this research. The activities of the research methodology are discussed in detail in Section 3.1. There are four main activities discusses which are identifying the integrity characteristic problem (Section 3.1.1), developing experimental model (Section 3.1.2), evaluating result (Section 3.1.3), and writing research report (Section 3.1.4). In order to develop the experiment model, three phases have been identified which are data gathering, data preparation for mining and integrity traits identification. The chapter summary is presented in Section 3.2.

3.1 Introduction

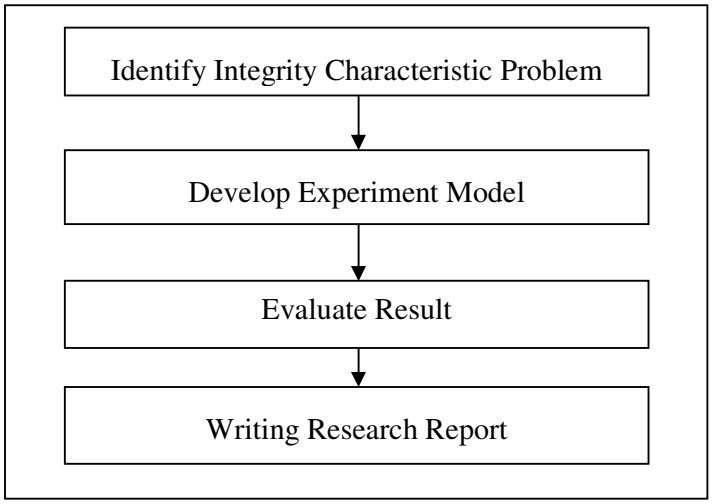


Figure 3.1: Steps of experimental research methodology

The experimental research methodology has been adapted to be used in this research. As shown in figure 3.1, there are four steps in this methodology which are identifying integrity characteristic problem, developing experimental model, evaluating result, and writing research report.

3.1.1 Identify Integrity Characteristic Problem

In problem identification, previous similar works were studied. It involved the review of books, journals, proceedings, research reports, and other academic related sources. The reviews covered the need of integrity for teacher; theories related to integrity, techniques to measure integrity and identify problematic teacher, as well as training related for teacher development. Besides that, we also examined data mining techniques mainly the association rule approach. The aim of this phase is to understand the area problem related to teacher integrity traits identification, finding gap, and propose solution to the identified problem. The output of this phase was a research proposal.

3.1.2 Develop Experiment Model

In the second phase, the experiment model is designed. The study was divided into three phases which started with data gathering, preparing data for mining and ended with pattern extraction. The details of the phases will be described in the following subsections. Figure 3.2 illustrates the data gathering, data preparation for mining and integrity traits extraction of this study.

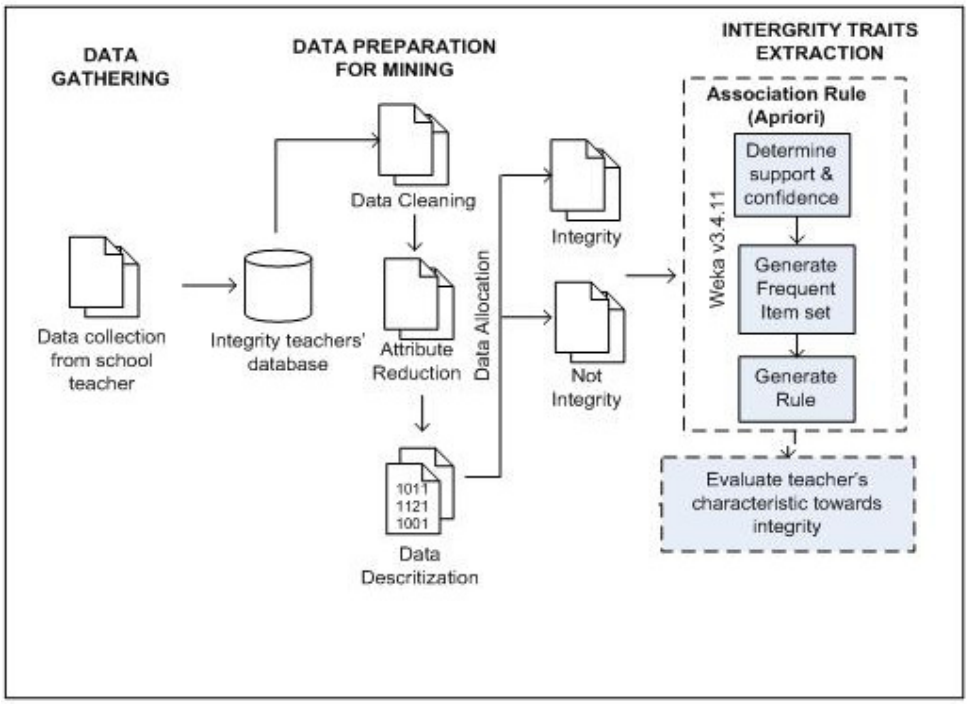


Figure 3.2: The experimental model

i. Data Gathering

The first step of this study is to obtain experiment data from school. In this study, a set of filled questionnaires of secondary school teachers in Langkawi Island, Kedah, Malaysia was selected as a case study. The questionnaire was designed by Langkawi Education District Office and it was distributed to teachers while attending training or seminar in the year 2009. There were 1500 respondents and 26 attributes including a decision class. The data set hold two decision class "Integrity" if the accumulative score of integrity test is more than 80% and "No Integrity" if the score is less than 80%. Out of 1500, 36.17% respondents were male and 63.87% were female teachers. Table 3.1 represents the distribution of respondents based on integrity level. The filled questionnaires were put into excel and named as Trainees Integrity Dataset (TID).

Table 3.1: Distribution of respondents based on integrity level

		Decision Class		
		Integrity	**No Integrity**	**Total**
Gender	**Female**	652	308	960
	Male	395	145	540
	Total	1047	453	1500

The TID represents two information which firstly is the five key traits on integrity of teachers and secondly is about their demographic background. The integrity elements are inherited from the Big Five Model (BFM) which is needed for stability, extraversion, originality, accommodation, and consolidation. The detail information about BFM is explained in literature section (2.1). Each of the five integrity elements; stability, extraversion, originality, accommodation, and consolidation in TID is represented with four set of questions. The questions are labeled with A1-A4 for Extraversion, B1-B4 for Consolidation, C1-C4 for Adaptability, D1-D4 for Stability and E1-E4 for Originality. Each integrity traits holds 20 marks with each of the questions contribute 5 marks. Table 3.2 displays the list of questions of each integrity trait.

Table 3.2: The list of questions of each integrity trait

Integrity Traits	**Questions[Variable]**
Extraversion	I will place the interests of the organization above personal **[A1]**
	I am ready to obey all rules, procedures and laws **[A2]**
	I fully understand the consequences that would be incurred if I commit an offense **[A3]**
	I am willing to carry out a task without expecting any reward or consideration **[A4]**

Consolidation	I will not use official facilities under my power for personal purposes **[B1]**
	I will not manipulate any important information for their own organizations **[B2]**
	I may accept error that I do **[B3]**
	I will adhere to the values of employment, even though it may threaten my life **[B4]**
Adaptability	I never make any false certificate during the period of my employment **[C1]**
	I will not highlight the excesses of any ability to be viewed as a success **[C2]**
	I choose to be honest in my promotion even had the opportunity to get it dishonestly **[C1]**
	I remain with the current work for interest, pleasure, and job satisfaction. If it is less I would prefer to find another job **[C4]**
Stability	I will always speak the truth even though in certain circumstances it may be difficult of my life **[D1]**
	I will always be honest and forthright on job performance feedback requested by the Department either on its own performance or colleagues **[D2]**
	I am always on time in doing the work **[D3]**
	I would not preclude any real evidence of the offense to me even in public **[D4]**
Originality	I will be open to accept any criticism and advice from the Head of Department or colleagues even if the offense committed was minor **[E1]**
	I will strive to fulfill the promise I made to the Head of Department, particularly in completing the tasks entrusted despite a moratorium on personal and family matters **[E2]**
	I can be patient, do any work until the end even took a long time, more than the official working hours**[E3]**
	I can accept anyone into the Head of Department or my colleagues, to try to adjust or change themselves into account, regardless of reputation, ethnicity, race and religion **[E4]**

For demographic background information, the attributes are gender, age, race, type of school, department, and position grade. Preliminary observation on the raw dataset shows that several attributes were not related to the study; certain values were missing

and duplicated. The next step is to pre-process the TID before it can be mined with AR algorithm.

ii. Data Preparation for Mining

The second step of the study is preparing the data for mining. This step involves data preprocessing activities whereby the problem in TID were identified and resolved. During preprocessing task, all dataset were pre-processed where all unknown numeric attributes were replaced with mean value while max value for character attributes. Since the AR algorithm in WEKA only accepts nominal type data, the dataset were then discretized using Boolean reasoning technique (Nguyen, 2011). To increase the mining speed and accuracy, only important attribute was given priority for mining and those attributes which were not related to the study were ignored.

During the selection process, 20 attributes which represent integrity test score were reclassified into five new groups based on the BFM model. The new groups were stability, extraversion, originality, accommodation, and consolidation. Each attributes represents an integrity question with the maximum score was 5. In this process, the sum score of each attribute based on the type of integrity was aggregated and the total score was 20. For example, the attributes A1, A2, A3, and A4 are the set of integrity question for Extraversion. Let say the score is given as A1=1, A2=4, A3=4, A4=1 then the total accumulative score for Extraversion is 10/20. Based on the accumulative score, the value is reclassified into two classes, either "15-20" or "0-14". The "15-20" group was considered as high score and "0-14" as lower. Figure 3.3 summarizes the process of attribute selection and reduction.

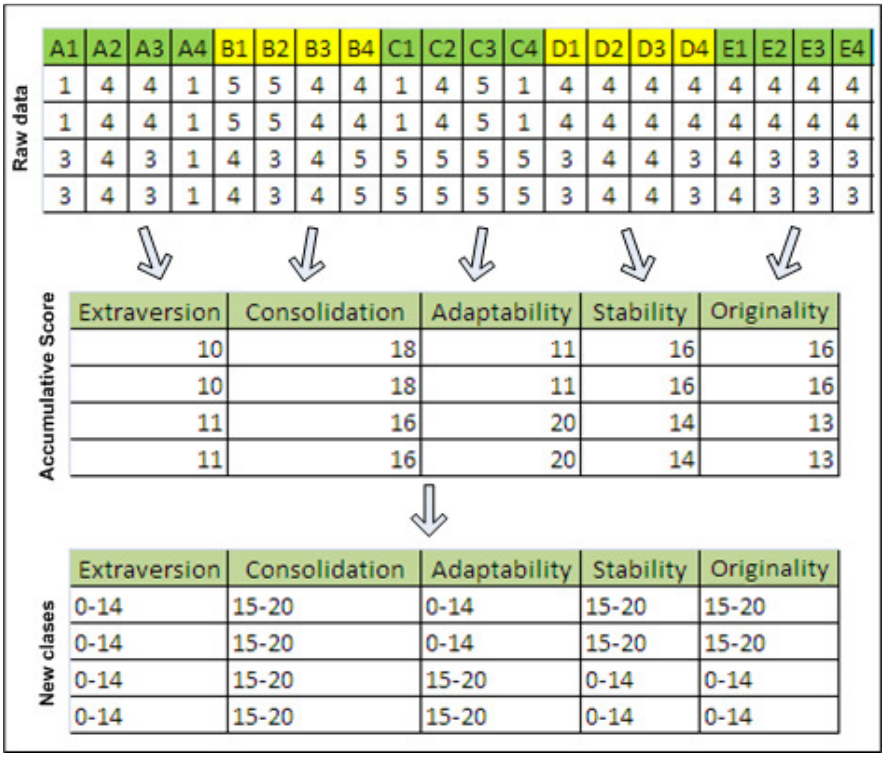


Figure 3.3: The process of attribute selection and reduction

In the final step of data preprocessing, TID was separated into “Integrity” and “No Integrity” group and only “No Integrity” group was presented to AR. The reason is to investigate the weakest trait of integrity that reflects teachers’ performance. Besides, it can concentrate into one group and this step can eliminate longer mining time as well as reducing the number of knowledge generated. After preprocessing, there was a remainder of 454 records out of 1500 and 10 attributes. The attributes were gender, age, position, grade, department, stability, extraversion, originality, accommodation, and consolidation. Table 3.3 shows the statistic of “No Integrity” group based on gender.

Table 3.3: The statistic of "No Integrity" group based on gender ready for mining

Gender		
Male	**Female**	**Total**
151	303	454

iii. Integrity Traits Identification

In pattern extraction, the experimental dataset are mined with data mining technique. For this study, AR algorithm called apriori in WEKA data analysis tool was chosen as pattern extraction tool (Wittenand & Frank, 2005). The clean TID dataset was presented to apriori algorithm and during mining, the length of frequent item set, support, and confidence value of each item set were recorded.

In this study, the minimum support value was set to 10% while confidence value was limited to upper than 95%. Besides that, the maximum number of rule was limited up to 1000. During data pre-process phase, TID dataset was separated into two groups that were integrity and no integrity. Only no integrity group was mined with apriori. Therefore, the knowledge extracted from apriori represents the combination of the most frequent integrity traits matching for less integrity teacher's group. The most frequent integrity traits matching are labeled as *F_iTC*. The next step is to evaluate the mined knowledge; *F_iTC*.

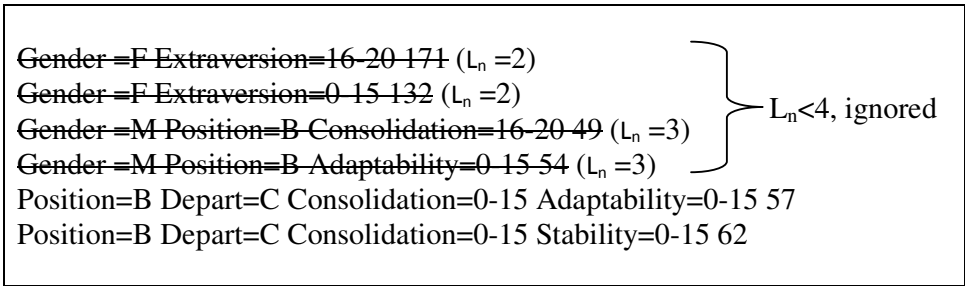
3.1.3 Evaluate Result

The knowledge generated from association rule is further evaluated in this phase. The knowledge extracted is in rule form and it represents the combination of the most frequent integrity traits matching of less motivated school teacher. This exploration

was divided into two parts. Firstly was to investigate the demographic trait. Secondly was to investigate the integrity criteria trait. The steps involved during evaluations are listed as follows:

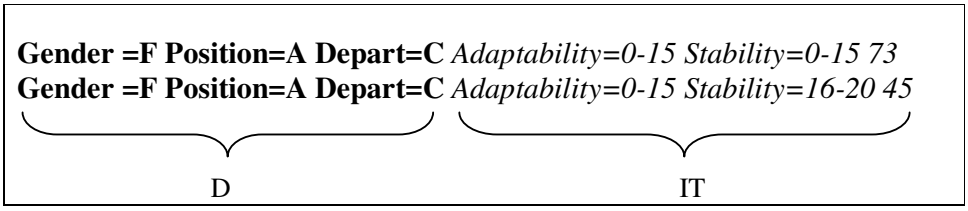
a) Scan the frequent trait matching combination (F_iTC) fold which is longer than 3, Ln>3

We focused at the *F_iTC* which is greater than 3 or L_n>3. The L_1-L_3 group were ignored as the trait is too compact and short. The process is shown as below:



b) Separates the integrity trait and demographic trait

In this step, both items were separated into two different groups as shown below. The reason is to re-mine the *F_iTC* based on integrity trait and demographic trait.



c) *Re-mined F_iTC*

To investigate how important are the traits toward teacher integrity performance, the *F_iTC* were re-mined based on integrity trait and demographic trait. During mining,

the occurrence of integrity trait and demographic trait were recorded. For integrity traits, only traits with lowest integrity score "0-15" were considered during this step and the number of combination were recorded. The example below shows the process of calculating the occurrence of integrity trait in *F_iTC*.

1. Consolidation=16-20 **Adaptability=0-15 Stability=0-15** 54
2. Consolidation=16-20 **Adaptability=0-15** Stability=16-20 47
3. Consolidation=16-20 **Adaptability=0-15** Originality=16-20 75
4. Consolidation=16-20 **Stability=0-15** Originality=16-20 53
5. **Adaptability=0-15 Stability=0-15 Originality=0-15** 49
6. **Adaptability=0-15 Stability=0-15** Originality=16-20 56

The trait marked with bold font carried the lowest integrity score "0-15" and it was counted during the mining. The mining result of this example is displayed in Table 3.4.

Table 3.4: The mining result of the example

Integrity trait	L_n	*Frequency*
Adaptability	1	5
Stability	1	4
Originality	1	1
Adaptability, Stability	2	3
Stability, Originality	2	2
Adaptability, Stability Originality	3	1

d) Finalizing the result

The results in step (iii) were finalized. The result were sorted and ranked. The trait combinations which ranked the top were considered as the most frequent combination.

3.1.4 Writing Research Report

The works of this study are documented in this phase. The writing process is run parallel with other task.

3.2 Summary

The study is an experimental research and the research methodology for this work is divided into four main activities which are identifying research problem, developing experimental model, evaluating result, and writing research report. As the first activity, the identifying research problem involves understanding research problem, finding gap and proposes solutions to the identified problem. The experimental model is developed in the second phase. It involves obtaining experiment data, preparing the data for mining and then mines the data using AR. The frequent integrity traits matching are the output of this phase. Then, in phase three, the traits matching are evaluated and finalized. The last activity of this work is preparing research report. The next chapter explains the finding of this study.

CHAPTER 4

RESULT

This chapter presents the analysis of this study. The TID dataset is mined with AR algorithm and the knowledge generated from the mining represents the most frequent weak integrity trait matching and demographic traits of school teacher. This analysis is divided into two parts. Firstly, is to investigate the integrity trait and secondly, is to explore the demographic trait. Then, this study proposes several components in order to present a conceptual framework of the teacher selection process of the training program. Lastly, the summary of the chapter is presented in Section 4.5.

4.1 The Level of Interesting Trait Matching of School Teacher

Table 4.1: The number of *F_iTC* according to L_n

	L_n						
	L_1	L_2	L_3	L_4	L_5	L_6	L_7
f_Char	21	155	432	533	299	72	5

After mining with apriori, there were 1000 rules generated with the maximum interesting traits combination (*F_iTC*) length is 7. Table 4.1 shows the number of *F_iTC* towards frequent item set length. L_n is representing the length and n is the number of attribute combination. For example, for L_4, there are four attributes combination. From Table 4.1, it is found that the highest *F_iTC* was generated in L_4 and it was followed by L_3, L_5, L_2, L_6, L_1 and L_7. Therefore, it can be said that the number of *F_iTC* is getting lesser when length increases.

Table 4.1: The number of *F_iTC* according to L_n

	L_n						
	L_1	L_2	L_3	L_4	L_5	L_6	L_7
f_Char	21	155	432	533	299	72	5

4.2 Exploring the Weakest Integrity Trait of School Teacher

Under integrity traits group, we concentrated our analysis at the weakest score of integrity. The *F_iTC* were scanned and all five integrity traits with the weakest integrity score between 0 and 15 were marked. The weakest integrity trait is marked bold as shown in Tables 4.2 and 4.3. However, the traits with normal font hold integrity score between 16 and 20 and they are considered as good integrity trait and ignored in the analysis. Total accumulative score is 20.

Table 4.2: The sample of integrity trait in *F_iTC* when the maximum trait matching length is L_n =4

F_iTC	L_n	*S%*
Adaptability=0-15 Stability=0-15	2	122
Adaptability=0-15 Stability=16-20	2	73
Adaptability=0-15 Originality=0-15	2	75
Adaptability=0-15 Originality=16-20	2	120
Stability=0-15 Originality=0-15	2	87
Stability=0-15 Originality=16-20	2	105
Stability=16-20 Originality=16-20	2	77
Extraversion=16-20 Consolidation=16-20 **Adaptability=0-15**	3	93
Extraversion=16-20 Consolidation=16-20 **Stability=0-15**	3	74
Extraversion=16-20 Consolidation=16-20 Originality=16-20	3	81
Extraversion=16-20 **Adaptability=0-15 Stability=0-15**	3	78
Extraversion=16-20 **Adaptability=0-15** Stability=16-20	3	49
Extraversion=16-20 **Adaptability=0-15** Originality=16-20	3	96
Extraversion=16-20 **Stability=0-15** Originality=16-20	3	73
Extraversion=16-20 Stability=16-20 Originality=16-20	3	46
Extraversion=0-15 Adaptability=0-15 Stability=0-15	3	48
Extraversion=0-15 Adaptability=0-15 Originality=0-15	3	46
Extraversion=0-15 Stability=0-15 Originality=0-15	3	45
Consolidation=0-15 Adaptability=0-15 Stability=0-15	3	53
Consolidation=16-20 **Adaptability=0-15 Stability=0-15**	3	73
Consolidation=16-20 **Adaptability=0-15** Stability=16-20	3	55

Table 4.3: The sample of integrity trait in *F_iTC* when the maximum trait matching length is L_n =5

F_iTC	L_n	S%
Adaptability=16-20 **Stability=0-15** Originality=16-20	3	55
Adaptability=0-15 **Stability=0-15 Originality=0-15**	3	91
Adaptability=0-15 **Stability=0-15** Originality=16-20	3	99
Adaptability=0-15 Stability=16-20 Originality=16-20	3	76
Extraversion=16-20 Consolidation=16-20 **Adaptability=0-15** Stability=0-15	4	78
Extraversion=16-20 Consolidation=16-20 **Adaptability=0-15** Stability=16-20	4	52
Extraversion=16-20 Consolidation=16-20 **Stability=0-15 Originality=0-15**	4	49
Extraversion=0-15 Consolidation=0-15 Adaptability=0-15 Originality=0-15	4	52
Extraversion=0-15 Consolidation=0-15 Stability=0-15 Originality=0-15	4	50
Extraversion=0-15 Adaptability=0-15 Stability=0-15 Originality=0-15	4	56
Consolidation=0-15 **Adaptability=0-15 Stability=0-15** Originality=0-15	4	58
Consolidation=16-20 **Adaptability=0-15 Stability=0-15** Originality=16-20	4	64
Consolidation=16-20 **Adaptability=0-15** Stability=16-20 Originality=16-20	4	61
Extraversion=16-20 Consolidation=16-20 **Adaptability=0-15** Originality=16-20	4	101

The information in Tables 4.2 and 4.3 are the samples of integrity trait matching in *F_iTC* with the maximum L_n=4 and L_n=5. The similar analysis was also conducted to *F_iTC* with the maximum L_n=6, and L_n=7. From the analysis, the occurrences of each of the weakest integrity traits were summarized and displayed in Table 4.4.

Table 4.4: The result of scanning process towards integrity score "0-15" in *F_iTC*

F_iTC	**E**	**C**	**A**	**S**	**O**
L_4	73	54	179	165	61
L_5	26	18	145	106	24
L_6	2	2	43	40	0
L_7	0	0	4	0	0
Total	101	74	371	311	85

E- Extraversion **C**- Consolidation **A**- Adaptability **S**-Stability **O**-Originality

From Table 4.4, it can be seen that adaptability is the weakest integrity trait among teachers. In all *n*, adaptability has the highest score which indicates most teacher are lacking at the adaptability aspect. This is closely followed by stability which also indicates less integrity among teachers. The score of other trait – extraversion, consolidation, and originality is considered low compared to adaptability and stability. Further observation was performed on the combination of more than one trait. The observation reveals that adaptability and stability traits were frequently occurred together in all *F_iTC*. For example, in L_4, there were 47 combinations of adaptability and stability and 37 were found in L_5. While in L_6, 10 combinations were recorded. This result indicates teacher who lack adaptability will also have problem related to stability. In addition, the combination of "stability and originality" and "adaptability and originality" was also high. As can be seen in L_4, there are 23 combinations of "adaptability and originality". The explanation of this part is summarized in Table 4.5. It indicates the frequency of the weakest trait for two traits combination in L_4, L_5, L_6 and L_7. In L_7, nothing interesting from the two traits matching was found.

Table 4.5: The frequency of *F_iTC* for two traits combination in L_4, L_5, L_6, and L_7

L4					
	E	**C**	**A**	**S**	**O**
E		-	16	-	-
C	12		-	18	11
A	-	-		47	23
S	19	-	22		25
O	15	-	-	-	
L5					
E		5	9	8	5
C	15		-	-	-
A	6	-		37	9
S	11	-	-		15
O	-	-	-	-	
L6					
E		-	1	-	-

C	-		-	-	-
A	-	-		10	1
S	-	-			1
O	-	-	-	-	
L7					
E		-	-	-	-
C	-		-	-	-
A	-	-		-	-
S	-	-	-		-
O	-	-	-	-	

E- Extraversion **C**- Consolidation **A**- Adaptability **S**-Stability **O**-Originality

For a combination of more than two traits, association rule generated several interesting traits matching. However, the number of combination is small. The information summarized in Table 4.6 is the interesting trait generated in L_4 with the number of combination is length 3 and length 4. From Table 4.6, adaptability and stability exist in all combinations (highlighted in bold). Besides that, extraversion is sent to be frequently paired with consolidation traits. The result is tailored with the *F_iTC* in L_5 as displayed in Table 4.7.

Table 4.6: The sample of *F_iTC* when the maximum trait matching length is L=4

F_iTC (L4)	**Length**	**S%**
Adaptability, **Stability**, Originality	3	7
Extraversion, **Adaptability**, **Stability**	3	4
Extraversion, **Adaptability**, Originality	3	4
Consolidation, **Adaptability**, **Stability**	3	6
Consolidation, **Stability**, Originality	3	4
Extraversion, **Adaptability**, **Stability**	3	4
Extraversion, Consolidation, **Stability**	3	3
Extraversion, Consolidation, **Adaptability**	3	3
Extraversion, Consolidation, **Adaptability**, **Stability**	4	1
Extraversion, **Adaptability**, **Stability**, Originality	4	1
Extraversion, Consolidation, **Stability**, Originality	4	1
Extraversion, Consolidation, **Adaptability**, **Stability**	4	1

Table 4.7: The sample of *F_iTC* when the maximum trait matching length is L=5

F_iTC (L5)	**Length**	**S%**
Adaptability, **Stability**, Originality	3	4
Extraversion, **Adaptability**, Originality	3	
Consolidation, **Adaptability**, **Stability**	3	6
Consolidation, **Stability**, Originality	3	
Extraversion, **Adaptability**, **Stability**	3	2
Extraversion, Consolidation, **Stability**	3	2
Extraversion, Consolidation, **Adaptability**	3	2
Extraversion, Consolidation, **Adaptability**, **Stability**	4	
Extraversion, **Adaptability**, Consolidation, Originality	4	3
Extraversion, Consolidation, **Adaptability**, **Stability**, Originality	5	1

However, starting from L_6, there are no interesting traits matching found with the condition of minimum trait combination more than two. As displayed in Table 4.8, the *F_iTC* in L_6 only generates interesting traits matching with maximum length L=2. Similar to L_7, no interesting combination was found.

Table 4.8: The *F_iTC* generated in L_6 with the maximum matching combination is two

F_iTC (L6)	**Length**	**S%**
Extraversion	1	2
Consolidation	1	2
Adaptability	1	43
Stability	1	40
Adaptability, Stability	2	11
Adaptability, Originality	2	1
Stability, Originality	2	1
Extraversion, Adaptability	2	2

In L_7 which represents the longest attribute combination, apriori has produced five rules as illustrated in Table 4.9. Hence, only adaptability trait appears to be the weakest integrity trait among teacher. Female teachers from group of grade A seem to

have the least integrity based on this frequent item set.

Table 4.9: The list of rules generated in L_7

F_iTC (L_7)	**Length**	**S%**
Gender =F Position=A Grade=B Depart=C Extraversion=16-20 Consolidation=16-20 **Adaptability=0-15**	7	47
Gender =F Position=A Grade=B Depart=C Extraversion=16-20 Consolidation=16-20 Originality=16-20	7	45
Gender =F Position=A Grade=B Depart=C Extraversion=16-20 **Adaptability=0-15** Originality=16-20		
Gender =F Position=A Grade=B Depart=C Consolidation=16-20 **Adaptability=0-15** Originality=16-20	7	46
Position=A Grade=B Depart=C Extraversion=16-20 Consolidation=16-20 **Adaptability=0-15** Originality=16-20	7	55

In general, the results indicate that adaptability and stability are the weakest traits among teachers due to the frequency of both traits exit in *F_iTC*. The other three characteristics also exist in *F_iTC* but due to their low occurrence, we decided to ignore them as weak integrity traits. According to literature; adaptability refers to the tendency of teacher to be compassionate and cooperative rather than suspicious and antagonistic towards others, while stability refers to the ability of teacher responding to stress, high work load and dealing with negative emotions. Since adaptability and stability are the weakest traits among teacher, the school management may organize suitable trainings to improve both traits.

4.3 Exploring the Demographic Traits of School Teacher

Under demographic analysis, we continued the analysis on the *F_iTC* by focusing at the demographic traits combination in L_4 until L_7. The sample in Table 4.10 is the demographic traits match in L_4 after they were separated with integrity traits.

Table 4.10: The list of rules generated in L_4 until L_7

***F_iTC* (Demographic traits, L_n=4)**	**S%**
Gender =M Position=B Gred=C	9
Gender =M Position=A Gred=B Depart=C	1
Gender =M Gred=C Depart= C	5
Gender =M Depart=C	14
Gender =F Age=26-30 Position=A Gred=B	1
Gender =F Age=26-30 Position=A Depart=C	1
Gender =F Age=26-30 Position=A	5
Gender =F Age=26-30 Gred=B Depart=C	1
Gender =F Age=26-30 Gred=B 47	2
Gender =F Age=26-30 Depart=C	5
Gender =F Age=26-30 48	7
Gender =F Position=B Gred=C Depart=C	1
Gender =F Position=B Gred=C	14
Gender =F Position=B	9
Gender =F Position=A	11
Gender =F Position=A Depart=C	10
Gender =F Position=A	18
Gender =F Gred=C Depart=C 81	8
Gender =F Gred=C	10
Gender =F Gred=B Depart=C	11
Gender =F Gred=B	19
Gender =F Depart=C	35
Gender =F	20
Age=26-30 Position=A Gred=B Depart=C	1
Age=26-30 Position=A Gred=B	5
Age=26-30 Position=A Depart=C	7
Age=26-30 Position=A	4
Age=26-30 Gred=B Depart=C	5
Age=26-30 Gred=B	1
Age=26-30 Depart=C	11
Age=26-30	3
Position=B Gred=C Depart=C	10
Position=B Gred=C	22
Position=B Depart=C	15
Position=B	8
Position=A Gred=B Depart=C	91
Position=A Gred=B	20
Position=A Depart=C	27
Position=A	16
Gred=C Depart=C	24
Gred=C	11
Gred=B Depart=C	24

Gred=B	11
Depart=C	40

From Table 4.10, the demographic traits in *F_iTC* were re-mined and the occurrences of each trait were recorded. From the analysis in Table 4.10, we found that the type of gender is not an important *F_iTC* to determine the integrity level of teachers. Even though the gender attribute had appeared 55.08% in L_4, both sexes have similar probability to behave with low integrity. Moreover, the study also found that the age group within "26-30" was the highest contributor in all *F_iTC* and interestingly, most of them were female.

The figure in Table 4.11 indicates the number of *F_iTC* according to age group. It was found that the salary grade and position were not strong traits to determine integrity. The similar analysis was also conducted to other demographic trait in *F_iTC* with the maximum L_n=5 ,L_n=6, and L_n=7.

Table 4.11: The number of *F_iTC* according to age

Age	***f_Char length***						
	L_1	L_2	L_3	L_4	L_5	L_6	L_7
20-25	63	4	2	0	0	0	0
26-30	150	16	46	58	31	3	0
31-35	85	5	4	0	0	0	0
36-40	75	5	4	0	0	0	0
41-45	0	0	0	0	0	0	0
46-50	0	0	0	0	0	0	0

4.4 A Component of Trainee Selection Module

Based on the above analysis, this study has further proposed an intelligent selection module components which consists of three components; personality characteristics

identification, training program requirements identification, and trainee selection agent.

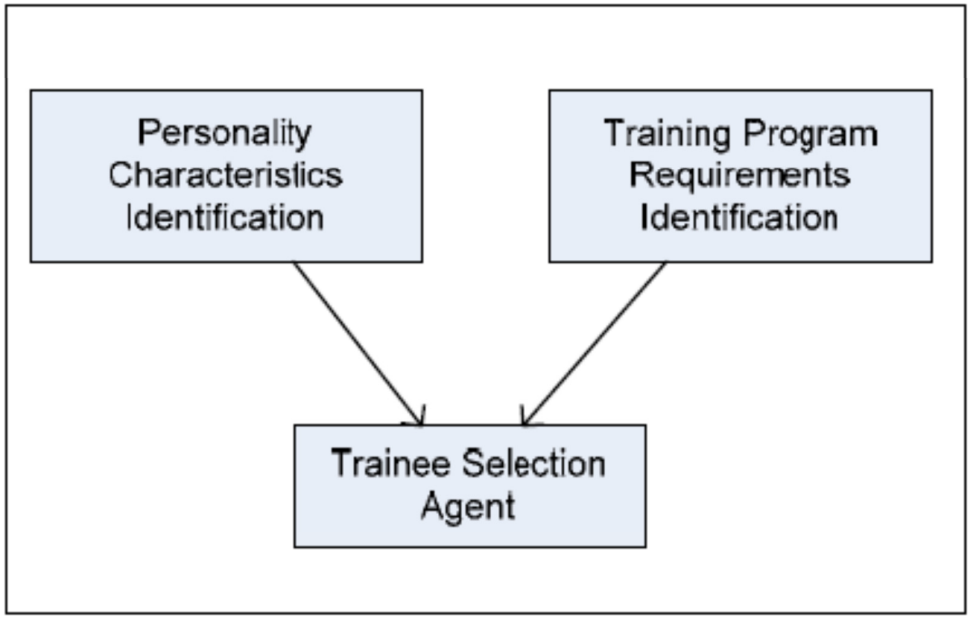


Figure 4.1: A trainee selection module for training program

The goals of this trainee selection module are to:

- determine the characteristics of the candidates
- determine the integrity level (weakest and strongest) of the candidates
- matching the training programs needs with the identified integrity level of candidates
- determine suitable candidates

i. Personality Characteristics Identification

This component is aimed to identify important characteristics of trainees that reflect their integrity and their integrity score. The intelligent technique of the trainee

selection module can be seen in this component whereby data mining technique called Association Rule (AR) is used to identify the characteristic. In AR, it relies on the concept of ―frequently occurred together which refers to process of the identifying of frequent items that occur in a database of transaction. Each item (*ij*) in a transaction is an important feature that contributed to the computation of item set and generation of rules. Basically, let $I = \{i_1, i_2, \ldots, i_m\}$ be a set of items and D be a set of transactions, where each transaction T is a set of items such as that $T \subseteq I$. An AR is an implication of form $X \rightarrow Y$, where $X \subset I$, $Y \subset I$, and $X \cap Y = \emptyset$. The rule $X \rightarrow Y$ has support s in the transaction D if $s\%$ of transactions id D contain $X \cup Y$. The rule $X \rightarrow Y$ holds in the transaction with confidence c if c% of transaction in D that contain X also contain Y.

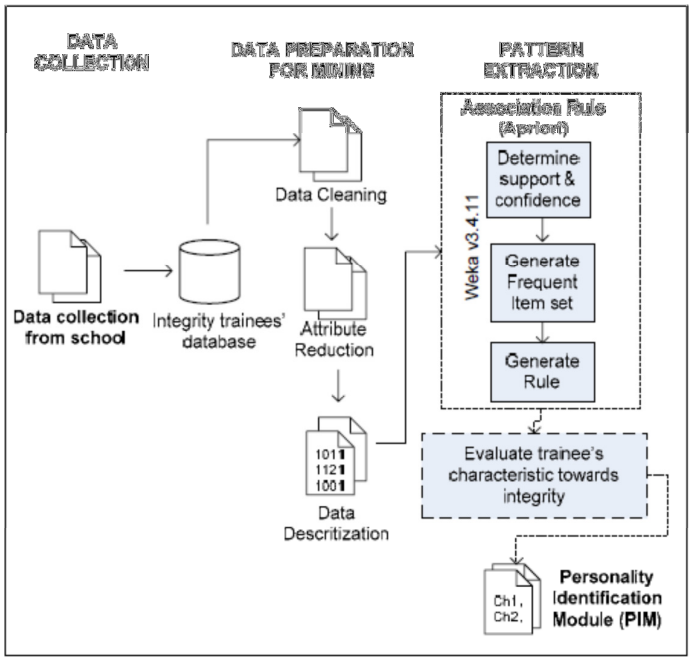


Figure 4.2: The personality characteristics identification component

The activity of this component is separated into three phases namely data collection, data preparation for mining, and pattern extraction. Figure 4.2 illustratively shows the personality characteristics identification component. During pattern extraction phase,

association rule algorithm called apriori in WEKA data analysis tool (Wittenand & Frank, 2005) will be used as pattern extraction tool.

TID will be presented to apriori and the knowledge generated from the algorithm will represent the important characteristics of trainees' integrity. The interest in this part is to investigate the weakest integrity characteristic with the hope that it can guide the training provider to organize training based on the area that is only required by the trainee. The set of integrity characteristic is shown in Five Factor Model and theoretically, human normally lacks at certain part of the characteristics and has the ability to change (Saulsman & Page, 2004). From the mining, the rules will be ranked based on support and confident threshold and only quality characteristic will be chosen for trainee selection model. The Personality Identification Module (PIM) is the output from this component.

ii. Training Program Requirements Identification

The aim of this component is to identify the requirements needed and provide total score for the training program requirements. It involves getting necessary information on entry criteria from the training provider and clustering that information into several components. For example, assume that *T1, T2…Tn* are the list of training available. The training provider will identify training criteria; *C1, C2,…Cn* required for each training such as objective of the course, age of trainees, and the main criteria; set of the integrity test result. Each criteria will be assigned with weight, *w* as given in *Tn={(Cn1,w1), (Cn2,w2),… (Cnm,wn)}*. Then, the overall score, *Sc* for the training will be produced. The *Sc* is an accumulative score of *Tn* where $Sc = w1 + w2 + \ldots + wn$. The weight will be based on the expert judgment. In this study, an expert is a LDEO.

The input of the component is a list of requirements gathered from LDEO as well as an intelligent PIM which is obtained from the previous module. PIM will be a guideline for LDEO to determine suitable training program based on personality characteristic of the candidates. The output of this component will be a set of training requirement segmented in several criteria, scores for each criteria, and an overall score. Figure 4.3 illustratively shows the training program requirements identification.

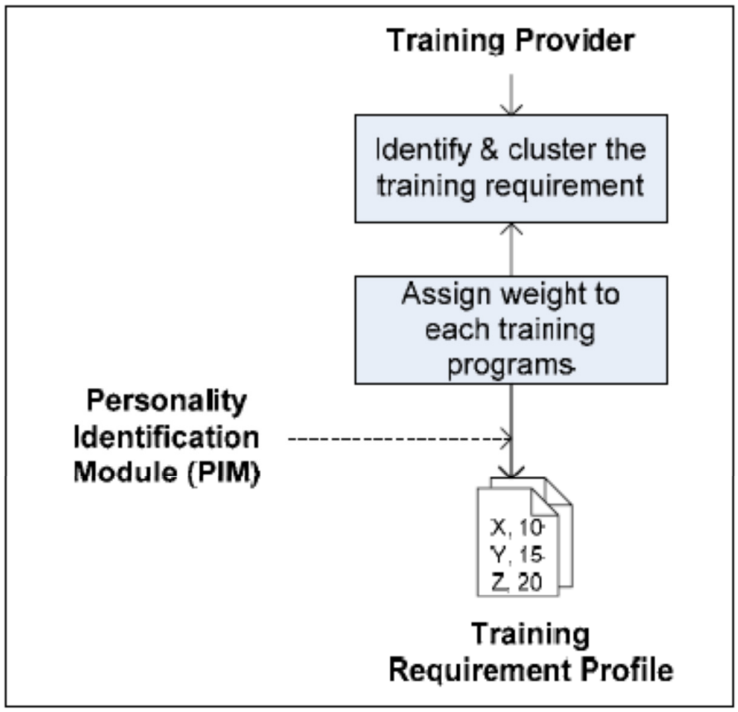


Figure 4.3: The training program requirements component

iii. Trainee Selection Agent

The trainee selection agent aims to obtain a shortlist of candidates. The process will involve matching candidates' personality scores with the training requirements overall score. Based on the integrity test which is required to be taken by a trainee, the result of the test will be mapped to overall score of the training. A mapping function is

given as X = (*RI, Sct)* whereby *RI* is the result of candidate integrity test result and *Sct* is an overall score of the training *t*, and *t* is the type of training. An algorithm will be developed to perform the matching and selection. Based on matching process, a list of candidates with *ITR* for the training program will be shortlisted and ranked based on the score of candidates. Figure 4.4 shows the activities involve in this component. There are two inputs required in this component which are a list of candidate profile with integrity test score and the training overall score. The output of this component is a list of shortlisted trainee.

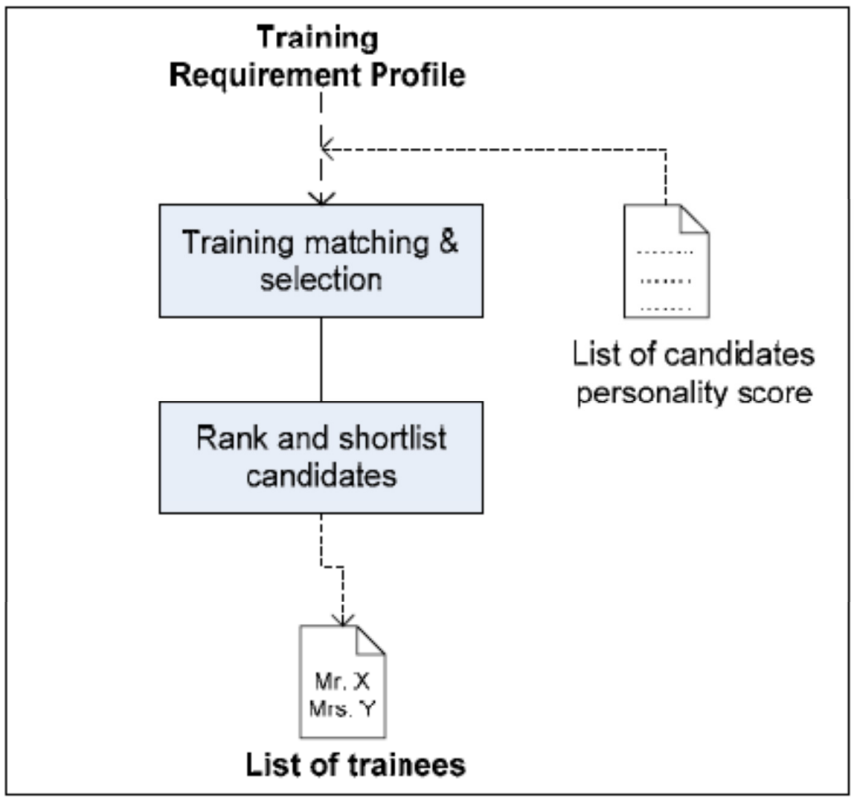


Figure 4.4: The trainee selection agent component

4.5 Summary

The analysis indicates that adaptability and stability are the weakest integrity trait among teachers. Teachers from the age group of 26 - 30 years are found to have lower integrity performance. However, other demographic factor such as gender, race, and grade position of teachers were not able to reflect their low integrity level in this study. Meanwhile, an intelligent based framework has been proposed in order to select suitable trainees for a training program. It is found that many motivational training programs fail to meet their objectives because there is a mismatch between the needs of training programs and the integrity levels of trainees. The proposed intelligent based framework consists of three components namely personality characteristics identification, training program requirements identification, and trainee selection agent.

CHAPTER 5

RECOMMENDATION AND FUTURE WORK

5.1 Conclusion

The main contribution of the study is to show how the intelligent model using association rule technique can identify the integrity traits among teachers adequately. From the study, it is also shown that the integrity traits among teachers can give a great influence to the selection process of training program. Results showed that the factors of adaptability and stability are the weakest traits among the teachers.

Thus, the findings of this study can be used to assist the school management in identifying integrity traits that are mostly lacking among teachers and proposes a suitable training program for them. In addition, the school management will be able to make a shortlist of candidate for training. School management can use this guideline to propose suitable training program for teachers to improve their integrity mainly on adaptability and stability.

This study also proposes the conceptual framework based on intelligent model which is aimed at facilitating key workers to select suitable trainees for a training program especially for teachers training program. The model is still under the development process. The proposed framework is intended to produce an efficient selection process

and suitable trainees. By selecting suitable candidates for the required training program, the organization can obtain quality performance from trained employees, at the same time, save time and money.

5.2 Future Work

The study aims to extend the literature on the development of a successful training program. Moreover, a main idea for the future work is also to integrate the intelligent based framework with the neural network predictor and genetic algorithm optimizer in order to produce a bestfit training program for any trainee.

REFERENCES

Agrawal, R., & Srikant, R. (1994*) Fast algorithm for mining association rules*, Proc. 20th Int. Conf. Very Large Databases, pp. 487- 449.

Ahmad, A. (2010) School teacher suspected rape 16 years old student, *The Star.* (online). www.thestar.com (5th July 2010)

Baker, J. (1990) Nobody's Perfect, But You Have To Be, *The Power of Personal Integrity in Effective Preaching*, New York: Mc Graw Hill.

Barrick, M. R., & Mount, M. K. (1991) The big five personality dimensions and job performance: A meta-analysis, *Personnel Psychology*, 44: 1 – 26.

Christensen, K. (2009) *The magazine*, Rotman school of management, University of Toronto, Fall, pp. 16 - 20.

Daniel, N. (2009) A test of character, *The Guardian* (London).

Dowding, M. (2011) *Northern Rivers Business Magazine*: Autumn.

Han, J., & Kamber, M. (2006) Data *mining concept and technique*, San Francisco: Morgan Kaufmann Publishers, 2006.

Han, J., & Kamber, M. (2001) *Data mining: Concepts and techniques*, Morgan Kaufmann Publishers.

Hassan, K. (2010) Guru Sekolah disyaki Merogol Pelajar Tingkatan 2, *Utusan Malaysia*, (Online) www.utusan.com.my (5th July 2010)

Hibadullah, C. F., & Norwawi, M. N. (2007) Classification of student's performance in programming course using decision tree, *The 5th International Conference on Information Technology in Asia*, Kuching, pp. 315 - 317.

Howard, P. J., & Howard, J. M. (2001) *The owner's manual for personality at work*, Austin, Texas: Bard Press.

Ma, Y., Liu, B., Wong, C. K., Yu, P. S., & Lee, S. M. (2000) Targeting the right students using data mining, *Proceedings of the Knowledge and Data Discovery (KDD2000)*, Boston, USA, pp. 457 - 464.

Mohamad Mohsin, M. F., Norwawi, N. M., Hibadullah, C. F., & Abdul Wahab, M. H. (2010a) Mining the student programming performance using rough set, *The Proceeding of 3rd IEEE International Conference on Intelligent System & Knowledge Engineering*, Hangzhou China, November 15-16 pp. 1045 - 1050.

Mohamad Mohsin, M.F., Norwawi, N. M., Hibadullah, C.F. & Abdul Wahab, M. H. (2010b) An Investigation into influence factor of student programming grade using association rule mining, *International Journal of Advances in Information Sciences and Service Sciences*, Vol 2.

Mohsin, M.F. & Abdul Wahab, M. H. (2008) Comparing knowledge quality in rough classifier and decision tree classifier, *Proceeding of 3rd IEEE International Symposium of Information Technology (ITSIM08)*, Kuala Lumpur, pp. 1109 - 1114.

Mount, M. K. & Barrick, M. R. (1998) Five reasons why the "Big Five" article has been frequently cited, *Personnel Psychology*, 51: 849 – 857.

Nguyen, H. S. (1998) Descretization problem for rough set methods, *Proc. of First Int. Conf. on Rough Set and Current Trend in Computing,* pp. 545 - 552.

Nillsen, R. (2004) The concept of integrity in teaching and learning, *Symposium on Promoting Academic Integrity*, Newcastle NSW.

Popper, K. R. (1983) *Objective Knowledge*, revised edition, Oxford University Press, Oxford.

Saulsman, L. M. & Page, A. C. (2004) The five-factor model and personality disorder empirical literature: A meta-analytic review, *Clinical Psychology Review*, 23 (8): 1055 – 1085.

Starling, J. W. (2009) The effects of teacher stability on third grade student achievement as measured by the North Carolina End-of-Grade tests in reading and mathematics, Gardner-Webb University. *Phd Thesis*.

Thornton, M. (2004) *Working with Integrity, Code Of Business Product*, BhpBiliton. (0nline) *www.bhpbilliton.com* (1st August 2010).

Wittenand, I. H., & Frank, E., (2005) *Data mining: Practical machine learning tools and techniques*, Morgan Kaufmann: San Francisco.

Wook, M., Yahaya, Y. H., Wahab, N., Isa, M. R. M., Awang, N. F., & Seong, H. Y. (2009) Predicting NDUM student's academic performance using data mining techniques, *Proceeding of the 2nd Second International Conference on Computer and Electrical Engineering (ICCEE '09)*, Dubai, pp. 357 – 361.