

***Modeling Student Affect in English Learning Achievement
Using Association Rules***

Fitra A. Bachtiar, Ritsumeikan University, Japan
Eric W. Cooper, Ritsumeikan University, Japan
Gunadi H. Sulisty, State University of Malang, Indonesia
Katsuari Kamei, Ritsumeikan University, Japan

The Asian Conference on Society, Education and Technology 2014
Official Conference Proceedings

Abstract

Educational studies have been conducted to search for methods of optimum learning. Student-teacher interaction is important in classroom settings for an environment conducive to learning. Most instructional practices thus far have explicitly included many more cognitive factors than affective ones. The affective factors are often neglected because they are considered private matters, far too long-term to be assessed, and poorly understood phenomena. As part of learning, emotion has been shown empirically to affect the quality of thinking and cognitive information processing. Some educators have suggested that certain teaching and learning activities are more likely to be successful when students are motivated by affective factors. An initial step to better understand student learning achievement based on the affective domain is to build profiles to infer student learning achievement. In this study, association rules are used to infer the relationship between student affective factors and performance in a learning setting. This study shows methods of revealing how student affective profiles are linked to their achievement in learning a second language. Factors influencing student learning are selected, classified, and used to form student affective profiles and to generate rules associating the factors with learning outcomes. The results show that both integrative motivation and intrinsic motivation show a positive and significant correlation with achievement. The resulting profiles are applicable as a basis to develop empirically-based teaching methods that explicitly include individual student affective aptitude.

Keywords: affective factors, student modeling, association rules, English learning

iafor

The International Academic Forum
www.iafor.org

Introduction

In recent years, research in education has been focusing on comprehensive studies for quality learning (Felder and Brent, 2005). Previous studies have found that interaction between teachers and students plays an important role in classroom settings (Efklides & Volet, 2005; Sathik & Sofia, 2013). In addition, motivating students through the affective domain hierarchy is more successful in certain teaching and learning activities (Shephard, 2008). Teaching and assessment in higher education generally focuses on cognitive skills rather than the affective domain. The affective domain is often neglected because it is believed to be a private matter, too long to be assessed within a time scale of any particular learning activity, and involves poorly understood phenomena (Meredith, Fortner, & Mullins, 1998; Shephard, 2008). Teachers however should be conscious of student affective traits as these traits play a significant role in learning. Teachers should develop their ability to give positive signals and avoid negative signals that could prevent learning. They also should create conducive learning environments where student can take risks, develop self-confidence, and grow emotionally and academically for successful learning (Rosbach, 2003; Sathik & Sofia, 2013).

Emotion has been shown empirically to affect the quality of thinking and cognitive information processing (Meyer & Turner, 2002; Wolter & Pintrich, 1998). In English learning, emotion is a key factor for English as a Foreign Language (EFL) learning (Fen, Fan, & Yang, 2013; Obeidat, 2005), which includes vocabulary learning (Sadeghi, 2013). Students have different levels in their affective factors, motivation and attitude, as well as responses to specific teaching and learning practices (Felder & Brent, 2005). These differences have impacts on student performances in English learning, as has been shown in some studies, for example, Wei (2007) who used anxiety and motivation as these factors have been recognized as prominent factors in student performance. Al-Tamimi and Shuib (2009), paired up motivation and attitude as factors that cause low English proficiency in engineering students. Addressing and treating these factors incorrectly may impact on the learning outcome.

In this paper a data mining technique, association rule mining, is used to understand student emotional traits in learning. Association rules were developed by Agrawal, Mannila, Srinivasan, Toivonen, and Verkamo (1996). Association rules are a method of representing acquired knowledge by identifying frequencies of adjacent relationships between items in a database (Garcia, Romero, Ventura, & de Castro, 2011). The goal of current study is to infer relationships between affective factors and performance in a learning setting, specifically to identify student affective profiles and to link them to the student general learning achievement in English. This paper is organized as follows: Section 2 presents a brief explanation about affective factors in learning and English learning. Section 3 describes questionnaire development and the subjects of this study. Section 4 explains the method proposed. In section 5, results and analyses of the proposed method are discussed. Section 6 concludes this paper by stating conclusions and future work.

Affective Factors

Affective factors in this present study are student emotions toward learning English as a foreign language. Affective factors in language learning are factors that deal with

student emotion and attitudes toward the target language (Bachtiar, Kamei, & Cooper 2012). The affective factors influencing students in language learning are various. According to Ellis (1995), an affective disposition character is influenced by individual factors, such as anxiety. Brown (2007) states motivation includes several affective factors that influence learning and divides motivation factors into intrinsic motivation and extrinsic motivation factors.

The proposed factors are factors commonly used in EFL research: motivation, attitude, personality, self-esteem, and anxiety (Al-Tamimi & Shuib, 2009; Bandura, 2006; Boekaerts and Boscolo, 2002; Dörnyei, 1998; Eysenck, 1968; Horwitz, 1999; John & Srivastava, 1999; Masgoret & Gardner, 2003; Myers & McCaulley, 1988; Obeidat, 2005; Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011; Pintrich, 2000; Wei, 2007; Zimmerman, 2000). Suitable factors from these studies are selected for the present study. Motivation factors identified in this study are Integrative Motivation, Instrumental Motivation, Resultative Motivation, Intrinsic Motivation, Global Motivation, and Task Motivation. Attitude factors are Attitude towards Community, Attitude towards Language, and Attitude towards Learning English. Personality factors consist of Introversion and Extroversion. Other factors, such as Anxiety and Self-Esteem, are independent variables that do not have sub factors. The proposed affective factors of interest are shown in Fig. 1.

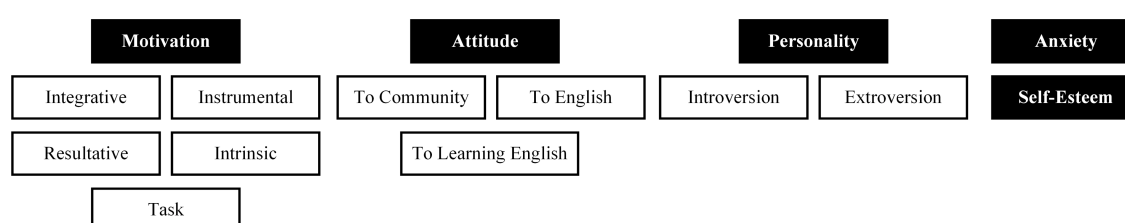


Fig 1. Proposed affective factors

Questionnaire Development and Subjects

Questionnaire Development

A questionnaire is developed to measure students' affective responses as an input to the system, a Likert scale with five possible responses. The response values range from five for strong agreement, to one for strong disagreement. The classification factors include motivation, attitude, personality, anxiety, and self-esteem. The proposed factors are then broken down into several causal corresponding variables, as shown in Fig. 1. The questionnaire for each of the constructs is a modified version of the questionnaires developed by Al-Tamimi and Shuib (2009), Bandura (2006), Eysenck (1968), Horwitz (1999), John and Srivastava (1999), Myers and McCaulley (1988), Obeidat (2005), Pekrun et al., (2011), and Wei (2007). Cronbach Alpha analysis was performed on the preliminary data collected to examine the internal consistency of the psychometric attributes of the questionnaire before data collection. In general, the value of consistency of the items of each variable ranges from moderate to good. The alpha values for each factor are as follows: Integrative Motivation $\alpha = .720$, Instrumental Motivation $\alpha = .588$, Resultative Motivation $\alpha = .802$, Intrinsic Motivation $\alpha = .834$, Task Motivation $\alpha = .691$, Attitude to Community

$\alpha = .729$, Attitude to English (language) $\alpha = .806$, Attitude to (English) Learning $\alpha = .783$, Introversion $\alpha = .531$, Extroversion $\alpha = .654$, Anxiety $\alpha = .838$, and Self-Esteem $\alpha = .683$. Students' scores are collected from documents recording their accumulative learning achievement.

Subject

The subjects of this study were 188 second year undergraduate English majors of two state universities in Malang City, East Java, Indonesia. Three parallel classes were selected in the English Department at the State University of Malang, with 88 students; three parallel classes were selected randomly in the English Department, Brawijaya University, with 100 students.

Method

The collected data are pre-processed into categories using Norm-References Score Interpretation (NRI). NRI is used to convert the quantitative score into levels for further qualitative classifications. NRI provides rankings for individuals relative to others. Four types of factor combination are proposed as inputs to the system in the form of transactions. Each transaction has aggregated factors. The factor combination of the transactions is as follows:

- Transaction 1: $M_{(IntM, InsM, ResM, IntrM, TasM)}$, Anxiety
- Transaction 2: $M_{(IntM, InsM, ResM, IntrM, TasM)}$, Attitude $_{(AttC, AttE, AttLE)}$, Personality $_{(IntP, ExtP, Anx, Sel)}$
- Transaction 3: $M_{(IntM, InsM, ResM, IntrM, TasM)}$, Attitude $_{(AttC, AttE, AttLE)}$, Personality $_{(IntP, ExtP)}$, Anxiety, Self-Esteem
- Transaction 4: IntM, InsM, ResM, IntrM, TasM, AttC, AttE, AttLE, IntP, ExtP, Anx, Sel

Association rules take transaction inputs and process them using the Apriori algorithm (Agrawal et al., 1996) using the pseudocode provided below:

Join Step: C_k is generated by joining L_{k-1} with itself

Prune Step: Any $(k-1)$ itemset that is not frequent cannot be a subset of a frequent set

Pseudocode:

C_k : Candidate affective and learning achievement itemset of size k

L_k : frequent affective and learning achievement itemset of size k

$L_1 = \{\text{frequent affective itemset}\}$

for ($k = 1; L_k \neq \emptyset; k++$) **do begin**

C_{k+1} = candidates generated from L_k ;

for each transaction in database **do**

increment the count of all candidates in C_{k+1} contained in t

L_{k+1} = candidates in C_{k+1} with min_support

end

return $\bigcup_k L_k$

There are three aspects that need to be considered in association rules: support, confidence, and lift. Support is the ratio of transaction supporting the association rule to the total number of transaction in the database. Confidence is percentage of transactions supporting the rule body and the lift is the amount by which the confidence exceeds the expected confidence.

For each of the models, parameters are set to a minimum support (MinSup) of $\{.10, .05, .01\}$ and minimum confidence (MinConf) is fixed at the value of $\{.80\}$. In accordance with the objective of this study, the antecedents are affective factors and the consequent is English learning achievement as shown in Table 1. The overall process is shown in Fig 2.

Table 1. Antecedent-consequent rule representation

Antecedents	Consequent
{Student affective features}	=> {Learning achievement}

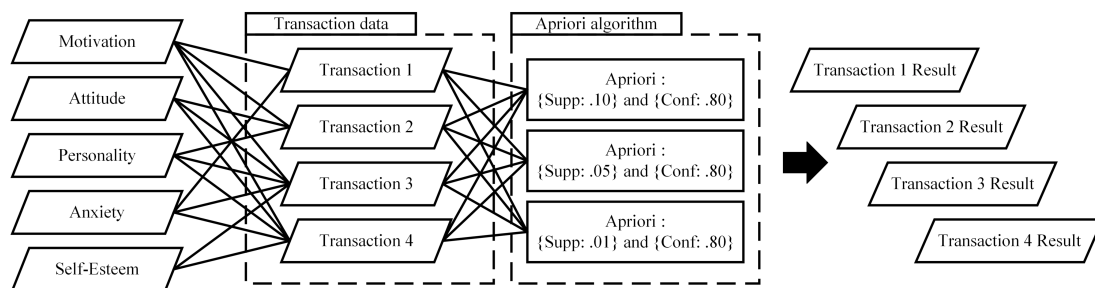


Fig 2. Process of conducting apriori algorithm

Correlation analysis is conducted to better understand each of the factors that influence scores reflecting students' achievement of English skills. To simplify the rules, the frequency of each affective factor in the ten rules with the highest lift is taken and the rule for each minimum support of $\{.05\}$ and $\{.01\}$ is then combined to describe the affective profile as one rule.

Result and Analysis

Result

The results of the Apriori algorithm are divided into four sections based on the transaction shown in Table 2. Transaction 1 only yields two rules of fair achievement of $\{.10\}$ minimum support. The rules are $\{Anx=High\} \Rightarrow \{A=Fair\}$ and $\{Mot=Mod, Anx=High\} \Rightarrow \{A=Fair\}$. Transaction 2 also yields in two rules of fair achievement of $\{.10\}$ minimum support. The rules are $\{Mot=Low, Pers=Low\} \Rightarrow \{A=Fair\}$ and $\{Mot=Low, Att=Mod, Pers=Low\} \Rightarrow \{A=Fair\}$. Transaction 3 yields 63 rules of Fair achievement of $\{.10\}$ minimum support. In this transaction most of the rules generated are fair learning achievement $\{A=Fair\}$, only one rule of poor learning achievement $\{A=Poor\}$, and no rules of good learning achievement $\{A=Good\}$. Meanwhile, Transaction 4 yields most number of rules with 16 rules of fair achievement of $\{0.1\}$ minimum support, in total 27 rules of good and fair rules of $\{.05\}$ minimum support, and in total 26295 rules of poor, fair, and good of $\{.10\}$ minimum support. The example of rules generated is shown in Table 3.

Table 2. Result generated from transaction 1-4

Transaction	Minimum Support	Minimum Confidence	Rules Generated	Consequent Generated
1	.10	.80	-	-
	.05	.80	-	-
	.01	.80	2	Fair
2	.10	.80	-	-
	.05	.80	-	-
	.01	.80	2	Fair
3	.10	.80	-	-
	.05	.80	-	-
	.01	.80	63	Fair, Poor
4	.10	.80	16	Fair
	.05	.80	270	Good, Fair
	.01	.80	26295	Good, Fair, Poor

Table 3. Rule example of good achievement

Rule No.	Rule	Support	Confidence	Lift
1.	{ResM=Low, TasM=Mod} => {A=Good}	.0106	1	3.1864
2.	{TasM=Mod, AttC=High} => {A=Good}	.0159	1	3.1864

Results of the correlation analysis for each transaction suggest that all factors used in Transaction 1 are significant to the English learning achievement. The motivation factor has the correlation of $r_{mot} = .252^{**}$ ($p < .001$) while the anxiety factor has the correlation of $r_{anx} = -.192^{**}$ ($p < .01$). In Transaction 2, only motivation factors correlate significantly with English learning achievement with $r_{mot} = .252^{**}$ ($p < .001$) while the other two factors, attitude and personality, do not significantly correlate with English learning achievement. In Transaction 3, two factors are correlated significantly with student achievement, motivation and anxiety, with correlation values of $r_{mot} = .252^{**}$ ($p < .001$) and $r_{anx} = -.192^{**}$ ($p < .01$). Attitude, personality, and self-esteem in this transaction are not correlated with learning achievement with the values of $r_{att} = .095$, $r_{pers} = -.024$, $r_{sel} = .066$. Four factors are correlated significantly in Transaction 4, integrative motivation, intrinsic motivation, extrovert personality, and anxiety with values of $r_{intM} = .247^{**}$ ($p < .01$), $r_{intrM} = .202^{**}$ ($p < .01$), $r_{extP} = .214^{**}$ ($p < .01$), $r_{anx} = -.192^{**}$ ($p < .01$) respectively. The correlation value of each transaction is shown in Tables 4 – 7.

Table 4. Correlation between factors for transaction 1

	Mot	Anx
A	.252**	-.192**
Sig (2-tailed)	.000	.008

** correlation is significant at the 0.01 level (2-tailed)

Table 5. Correlation between factors for transaction 2

	Mot	Att	Pers
A	.252**	.095	-.096
Sig (2-tailed)	.000	.194	.192

** correlation is significant at the .01 level (2-tailed)

Table 6. Correlation between factors for transaction 3

	Mot	Att	Pers	Anx	Sel
A	.252**	.095	-.024	-.192**	.066
Sig (2-tailed)	.000	.194	.747	.008	.369

** correlation is significant at the .01 level (2-tailed)

Table 7. Correlation between factors for transaction 4

	IntM	InsM	ResM	IntrM	TasM	AttC	AttE	AttLE	IntP	ExtP	Anx	Sel
A	.247**	.154*	.110	.202**	.081	.125	-.005	.069	-.173*	.214**	-.192**	.066
Sig (2-tailed)	.001	.034	.134	.005	.269	.089	.946	.343	.017	.003	.008	.369

** correlation is significant at the .01 level (2-tailed)

Analysis

Transaction 1 uses motivation and anxiety factors to explain student motivation and anxiety generally. Frequent patterns are revealed in transaction 1 in which ‘moderate motivation’ and ‘high anxiety’ are an evident result in a fair learning achievement as shown in Fig 3. A possible example of this rule may occur in the case where a student’s moderate motivation overcomes their anxiety. Referring to the Table 4, the motivation factor shows a positive correlation (.252**; $p < .001$) in accordance with work by Masgoret and Gardner (2003) who reveal a positive and significant relationship between motivation and learning English. The anxiety correlation (-.192; $p < .01$) in this study is supported by findings by Wei (2007), who states if the student is anxious then ineffective learning will occur. When associated with the correlation for each factor, students tend to have good learning achievement when they have more motivation. The higher anxiety a student has, the lower achievement the student gets in the class.

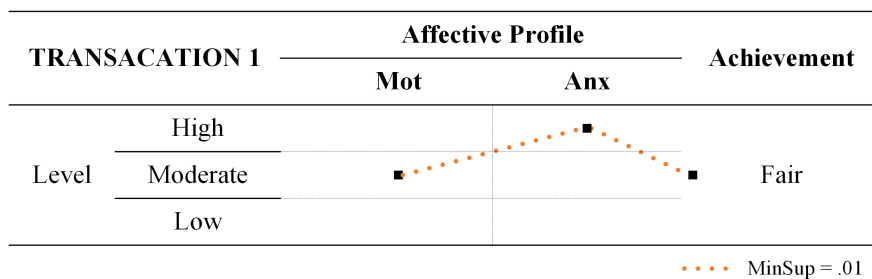


Fig 3. Rule representation of fair achievement in transaction 1

Transaction 2 generates the fair learning achievement {A=Fair}. Motivation, attitude, personality are used to infer student emotion profiles. The pattern shows that student with low motivation, moderate attitude, and low personality will get fair learning achievement. The association rules in Fig 4 shows that even when students are low in motivation and low in positive personality traits, but they have moderate attitude, they are likely to get a fair learning achievement. A possible explanation for this comes from empirical evidence showing that attitude itself relates with integrative motivation (Masgoret & Gardner, 2003). Integrative orientation in an individual who learns English is an expression of interest in learning the language to interact, socialize, make friends, etc. with members of English speaking community. Thus,

although students' affective factors like motivation and positive personality traits are low, they still can obtain fair achievement when they have moderate attitude.

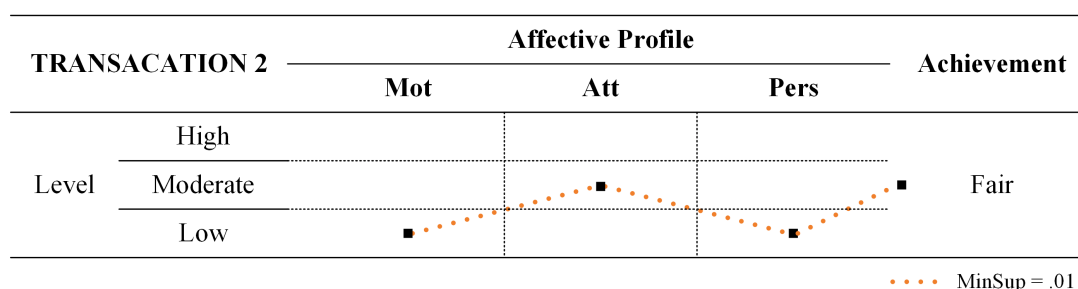


Fig 4. Rule representation of fair achievement in transaction 2

Fig 5 suggests that students will have a fair learning achievement under conditions represented as follows: when students are moderately motivated, and have moderate attitude, but their personality, anxiety, and self-esteem are low. An average score is achieved in the condition of moderate motivation and low anxiety but with low personality and low self-esteem. Brown (Brown, 2007) stated that students with low self-esteem are incapable of carrying out given tasks due to lack of confidence. Fig 6 suggests that even when students have high attitude, if they have introverted personalities, they will not have effective learning outcome.

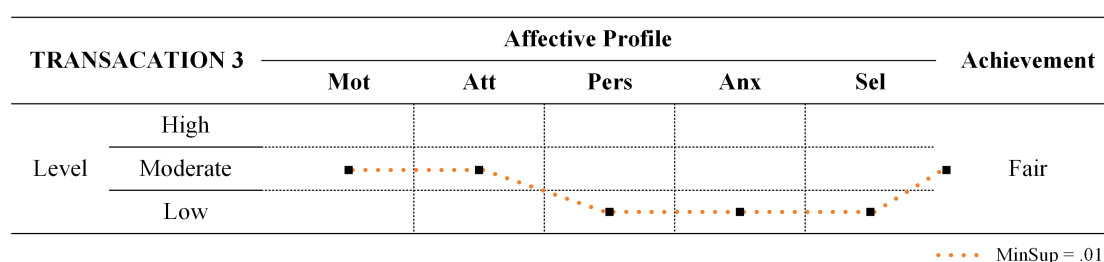


Fig 5. Rule representation of fair achievement in transaction 3

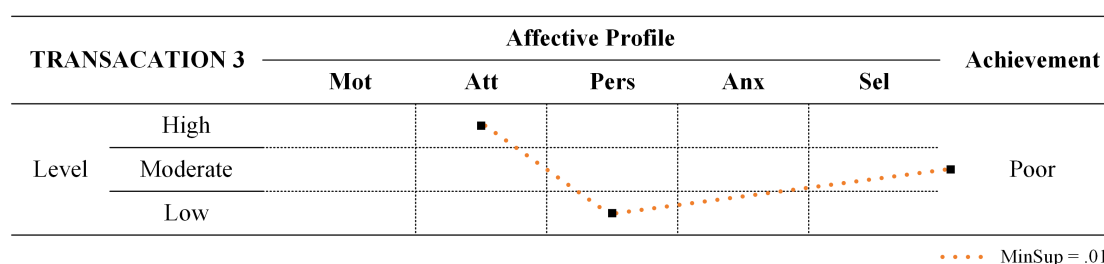


Fig 6. Rule representation of poor achievement in transaction 3

Transaction 4 uses all affective sub factors. All of the learning achievement types in the consequent are obtained with different transaction parameters. The assumption that arises is that good achievers' affective profile are students who feel that studying English is important for themselves and who value the learning, as shown in Fig 7. Another noteworthy profile is a profile in which students with high instrumental motivation, high attitude to community, high extroversion but low intrinsic motivation, low attitude in learning English will also get a good learning achievement. There are two affective profiles for fair achievers in transaction 4 as shown in Fig 8. The first one is the students who take the learning as it is, who have a moderate level in their affective profile such as integrative motivation, instrumental motivation,

attitude to community, and who have a high attitude toward learning English. The second profile of fair achievers is students who are more likely to use English as a means to achieve a further goal, who are intrinsically motivated toward learning, who use English as a means to do other tasks, who are not active, and have high anxiety in learning. Meanwhile, for poor achievers, their affective profile is in low categories for task motivation and extroversion, as can be seen in Fig 9. One explanation for this is that the students do not use English to perform another task such as understanding literature written in English. In addition to this, the students are also less active as shown by low extroverted personality in the rules. Furthermore, these students do not have a clear orientation in the use of English as means to achieve something (e.g. to get a job that requires English).

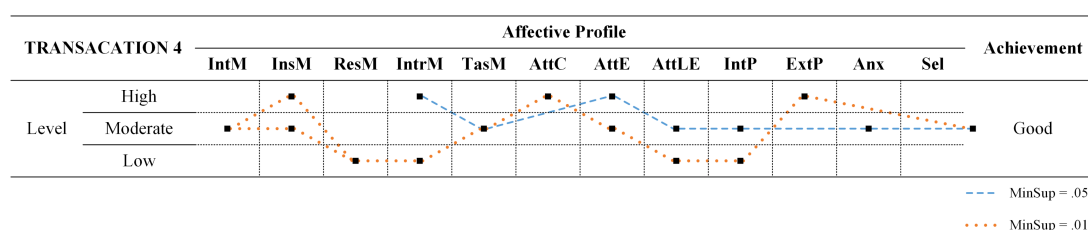


Fig 7. Rule representation of good achievement in transaction 4.

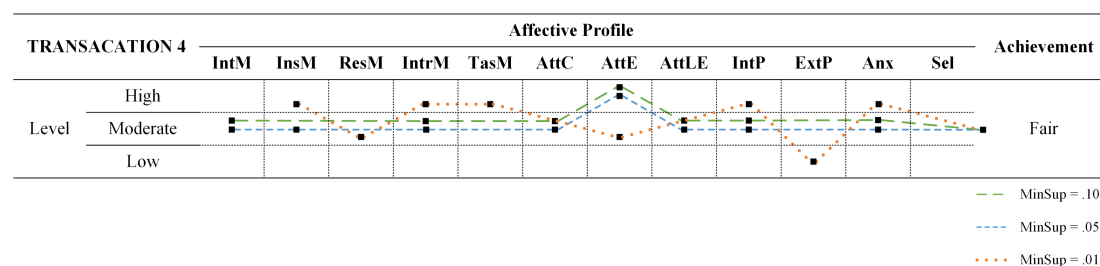


Fig 8. Rule representation of fair achievement in transaction 4.

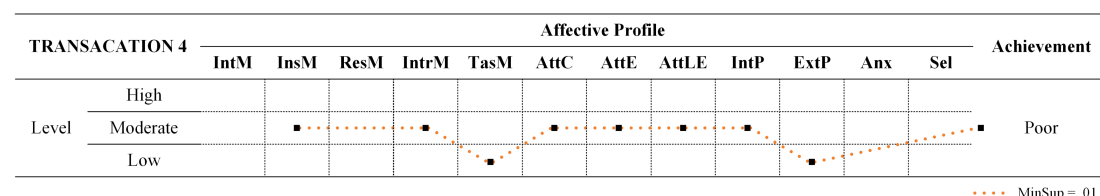


Fig 9. Rule representation of poor achievement in transaction 4.

Conclusion and Future Work

A preliminary study to understand students' emotion in English learning achievement through association rules is described. There are several points that are offered for further studies. Firstly, further studies should consider the general factors influencing students' learning in a variety of subjects. Secondly, to study in depth about factors influencing student learning, the factors should focus on specific aspects. Studies by Pekrun et al. (2011) differentiated the affective factors based on several aspects such as classroom environment, tests, and exams. Third, the rules generated still need to be enhanced to be easily understood by teachers as practitioners or others. Formulation of the rules needs to be validated to experts in English teaching and learning to give a better understanding of the student emotion in the learning context with the comprehension outcome. Fourth, the results obtained in this study were based on the

frequent item set. As a result, the rare item sets that would be useful are not yet included in an effective manner.

An attempt to model student affective profiles is described in this study. Methods of selecting affective factors are described to model student learning achievement based on their affective factor profile. The selected affective factors are then preprocessed in the form of qualitative values and decoded into transaction data. Each of the transaction data sets is used to explain the student affective profile in general and in detail. Mining rules in each of the transactions are performed to generate affective profile rules using different parameters. All types of student learning achievement of English in respect with affective profiles are obtained using different parameters. Rules obtained are then simplified in the form of *if-then* rules and are presented in a graphical format to be more easily interpreted than in the antecedent-consequent form. Finally, rules obtained are interpreted to illustrate latent patterns in student affective profiles.

The preliminary analyses may be used as a basis to understand more about students' emotion in learning in general subjects. This allows teachers to analyze cases of student learning problems associated with their affective factors, to overcome them, and to improve their performance in learning or for curriculum development to include emotion as an explicit part of program development.

References

- Agrawal, R., Manilla, H., Srinivas, R., Toivonen, H., & Verkamo, A. I. (1996). *Fast Discovery of Association Rules: Advances in Knowledge Discovery and Data Mining*. Menlo Park, CA: AAAI Press.
- Al-Tamimi, A., & Shuib, M. (2009). Motivation and attitudes towards learning English: A study of petroleum engineering undergraduates at Hadhramout University of Sciences and Technology. *GEMA Online Journal of Language Studies* 9.2.29-55.
- Bachtiar, F.A., Kamei, K., & Cooper, E. W. (2012). A Neural Network Model of Students' English Abilities Based on Their Affective Factors in Learning. *JACIII*, 16(3), 375-380.
- Bandura, A. (2006). *Guide for Constructing Self-Efficacy Scales*. *Self-Efficacy Beliefs of Adolescents*, edited by Frank Pajares and Tim Urdan. A Volume in Adolescence and Education, Age Publishing.
- Boekaerts, M., & Boscolo, P. (2002). Introduction: Interest in learning, learning to be interested, *Journal of Learning and Instruction* 12.375 – 382.
- Brown, H.D (2007). *Principles of Language Learning and Teaching 5th Edition*. New York: Pearson Education Inc.
- Dörnyei, Z. (1998). *Motivation in Second and Foreign Language Learning*. Cambridge University Press.
- Efklides, A., & Volet, S. (2005). Emotional experiences during learning: Multiple, situated and dynamic. *Learning and Instruction* 15.5. 377-380.
- Ellis, R. (1985). *Understanding Second Language Acquisition* (Vol. 47, p. 73). Oxford: Oxford University Press.
- Eysenck, H. J. (1968). *Eysenck Personality Inventory*. San Diego: Educational and Industrial Testing Service.
- Felder, R.M., & Brent, R (2005). Understanding Student Differences. *Journal of Engineering Education*, Vol. 94, No.1. 57-72.
- Feng, H.Y, Fan, J.J. & Yang H.Z. (2013). The relationship of learning motivation and achievement in EFL: Gender as an intermediated variable. *Educational Research International*, 2(2), 50-58.
- Garcia E., Romero, C., Ventura, S., & de Castro, C. (2011). A collaborative educational association rule mining tool. *Internet and Higher Education* 14.77-80.
- Horwitz, E. K. (1999). Cultural and situational influences on foreign language learners' beliefs about language learning: a review of BALLI studies. *System* 27.4. 557-576.
- John, O. P., & Srivastava, S. (1999). *The Big-Five Trait Taxonomy: History, Measurement, and Theoretical Perspectives*. In L. A. Pervin & O. P. John (Eds.), *Handbook of Personality: Theory and Research* (Vol. 2, pp. 102–138). New York: Guilford Press.
- Masgoret, A–M., & Gardner, R.C. (2003). Attitudes, motivation, and second language learning: a meta–analysis of studies conducted by Gardner and associates. *Language Learning* 53.1.123-163.
- Meredith, J. E., Fortner, R. W., & Mullins, G. W. (1997). Model of affective learning for non-formal science education facilities. *Journal of Research in Science Teaching*, 34(8), 805-818.
- Meyer, D. K., & Turner, J. C. (2002). Discovering Emotion in Classroom Motivation Research. *Educational Psychologist*, 37(2). 107–114.

- Myers, I. B., & McCaulley, M. H. (1988). *Myers-Briggs Type Indicator*: MBTI. Consulting Psychologists Press.
- Obeidat, M. M. (2005). Attitudes and motivation in second language learning. *Journal of Faculty of Education* 18.22 (2005): 1-17.
- Pekrun, R., Goetz, T., Frenzel, A. C., Barchfeld, P., Perry, R.P. (2011) Measuring emotions in students' learning and performance: The Achievement Emotions Questionnaire (AEQ). *Contemporary Educational Psychology* 36.1 (2011): 36-48.
- Pintrich, P.R. (2000). An achievement goal theory perspective on issues in motivation terminology, theory, and research. *Contemporary Educational Psychology* 25.1 (2000): 92-104.
- Rosbach, B. (2003). *The Learning Classroom: Theory into Practice*. Annenberg/CPB Course Guide, Stanford University.
- Sadeghi, M. (2013). The impact of achievement motivation on vocabulary learning in intermediate EFL learners. *Journal of Basic Applied Scientific Research*. 3(10) 206 – 213.
- Sathik, M. M., & Sofia, G. (2013). Deriving Association between Student's Comprehension and Facial expressions using Class Association Rule Mining. *International Journal of Engineering & Technology* (0975-4024), 5(3).
- Shephard, K. (2008). Higher education for sustainability: seeking affective outcomes, *International Journal of Sustainability in Higher Education*. Vol 9. No. 1, pp. 87 – 98. Emerald Group Publishing Limited. 1467-6370. DOI 10.1108/14676370810842201.
- Wei, M. (2007). The interrelatedness of affective factors in EFL learning: An examination of motivational patterns in relation to anxiety in China. *TESL-EJ* 11.1 (2007): 1-23.
- Wolters, C.A., & Pintrich, P.R. (1998). Contextual differences in student motivation and self-regulated learning in mathematics, English, and social studies classrooms. *Instructional Science* 26.1-2 (1998): 27-47.
- Zimmerman, B.J. (2000). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology* 25.1 82-91.