Assessing Mathematics' Attitude among Technical University Students

Mislina Atan
Faculty of Technology Management and Technopreneurship, Universiti Teknikal Malaysia Melaka

Fauziah Kasmin
Faculty of Information and Communication Technology, Universiti Teknikal Malaysia Melaka

DOI: 10.6007/IJARBSS/v7-i14/3655 URL: http://dx.doi.org/10.6007/IJARBSS/v7-i14/3655

Abstract
Technical education has been highlighted as a focus component in developing more experts in Malaysia. The growth in numbers of expert in technical area for one country has been said as one of the indicator toward developed country. As a foundation to produce more experts technologist in technical area, mathematics has been identify as a major subject that technical students need to mastered. Thus, the purpose of this study was to examine mathematics' attitude among technical university students. The data were collected from 278 university technical students. The respondents were assigned to complete Student Attitude Survey (SAS). Later, the data was analyzed using descriptive statistics and factor analysis. The finding shows there were four components extracted from the factor analysis. The findings significance to most mathematics educators in technical higher learning institution in order to have better view and readiness to plan their teaching method according to technical students attitude towards mathematics.
Keywords: Attitude, Mathematics, Technical students, TVET, factor analysis.

Introduction

Malaysia is moving toward high income country and seriously moulding a creative and innovative generation. To achieve this objectives, Mathematics seems to be one of the important foundation since most of knowledge regarding technologies and science in innovations emerge from Mathematics. Even, to obtain a sustainable development in our country, Mathematics play an important role as research has shown that, mathematical model can describe and solve many developmental challenges. Furthermore, mathematics helps and allows us to sustain most of human activities.

The subject of mathematics not only has a significant role in different sciences, but its training also fortifies reasoning and intellectual structure. For such reasons, the learning of mathematics, considered essential in the field of education, was deemed a worthy subject for this study. Our society have recognized that the knowledge of mathematics is an

important instrument in our daily life. From mathematics, students can interpret, describe, analyze, predict and solve problems. Compare to other subjects, more mathematics education have been taught in schools worldwide (Mohamed & Waheed, 2011). It is also widely known, mathematics have been a key role for shaping individual's action to adapt with various components of life (Anthony & Walshaw, 2009). In order to build up skills of creative thinking, Mathematics is considered as a part of education requirements in schools (Tarver, 2015). All higher institutions particularly in Malaysia have set a requirement that is students need to have studied mathematics before entering engineering undergraduate degree courses (Othman et al., 2012).

However, most of the students unable to relate mathematical concept in solving real life problems. Owing to its abstract concepts, learning mathematics is difficult for young teenagers. Some of the students only learn mathematics to fulfill the minimum requirements for finishing their high school. This kind of mind set should be transformed since it affects the development of the society. Majority of students dislike mathematics and standard evaluations exposed that low performance of mathematics and students do not achieve the expected level of mathematics (Mohamed & Waheed, 2011). The problem of low performance in mathematics among students have been a major concern worldwide. From a study by Organisation for Economic Cooperation and Development (OECD), it is stated that the proficiency of mathematics and science among 15 year old Malaysians is low among developed countries in 2012. In 2015, Malaysia have been ranked in 52nd out of 72 countries in Programme for International Student Assessment (PISA) results (Jackson, 2016). Students who are weak in learning mathematics will influence the process of making a developed Malaysians in 2020 (Zakaria, Zain, Ahmad, & Erlina, 2012). Some of the consequences of failing Mathematics subject are include disable to grasp ambitions in professional and academic efforts. In the study of students' interest in science-related careers, it is found that 67% respondents chose careers that were unrelated to science. Some actions need to be taken to rectify this issue.

Despite its importance, mathematics is considered as the most difficult course in every grade. Most students have difficulties with mathematical concepts and are afraid of learning the subject. As stated in (Karagiannakis, Baccaglini-Frank, & Papadatos, 2014), mathematics is a complex subject that includes several domains such as arithmetic, algebra, calculus and etc that need various abilities correlated towards memory, symbols decoding, logics and many more. Mathematical learning difficulties may affect to students with problems in coordination of these abilities (Karagiannakis et al., 2014). In the research done by (Tambychik & Meerah, 2010), students are reported to have problems in problem solving in mathematics. They have difficulties to apply and integrate mathematical concepts and skills and hence cannot make decisions. The researchers have concluded that the difficulties faced by the students in problem solving are due to incompetence of acquiring mathematics skill and the students are also lack in cognitive abilities such as recall, memorize and perceive in learning. Abstractness, symbols, accuracy, notations are

some of natures of mathematics that made students difficult to understand (Abdul Gafoor & Sarabi, 2015). For engineering students, mathematics have been identified as one of the most challenging courses to study (Kashefi, Ismail, Yuso, & Rahman, 2011). Research done by (Kashefi et al., 2011) have proposed a framework to enhance the technique of learning mathematics by engineering students. The framework have used Creative Problem Solving and this technique include how to solve problem critically, communication and as well as competence in team work. Figure 1 show the focus of mathematical learning done by (Kashefi et al., 2011). There are three factors identified by (Suan, 2014) that influence underachievement in mathematics. The three factors are teacher factors, student factors and the third is environmental factors. Based on their findings, student factors which includes interest and attitudes towards mathematics, study habits and time management have direct impact towards achievements in mathematics.

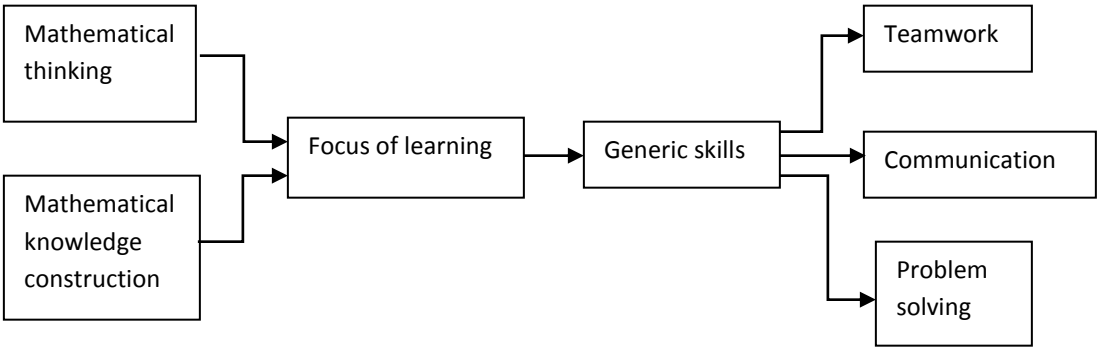

Figure 1 Focus of mathematical learning

Currently, Ministry of Education instill science, technology, engineering and mathematics (STEM) in a curriculum to equip students and graduates that fulfill the needs of industry. STEM assimilates learning paradigm that nurture logical reasoning, inquiring minds and collaboration skills based on real-world applications. These competencies includes deep knowledge of a subject, problem solving, creativity, critical thinking and communication skills play an important role to a wide range of employments. International research show that 75% of the fastest growing occupations now require STEM skills and knowledge (Office of the Chief Scientist, 2014). Apart from STEM, technical education also has been highlighted as a focus component in developing more experts in Malaysia (Mahazir I., Norazah, Ridzwan, & Rosseni, 2013). The growth in numbers of expert in technical area for one country has been said as one of the indicator to be developed country. Hence, in order to build a foundation for understanding the scientific basis of technology, mathematics and science are mandatory to be introduced into the TVET curriculum, especially for the engineering trades (Gamble, 2013).

Mathematics learning generally involve both cognitive and affective domain. However, recent study emphasis more on affective domain than the cognitive (Maltese & Tai, 2011). Attitudes, motivation, beliefs, emotion and interest are among the constructs in the affective domain that

contribute as important determinants of the quality and depth of learning process, participation of the classroom activities, student persistence on a given task, their way of studying, as well as their future preferences (Hidi & Renninger, 2006; Maltese & Tai, 2011; Schloglmann & Wedege, 2007). Sustainability in teaching and learning processes of mathematics also require further investigation in students' attitude towards mathematics. It is due to the finding that reveals positive attitude will increase the success of the students in mathematics (Farooq & Shah, 2008). Positive attitude also has a significant impacts on students' effective engagement, participations and achievements in mathematics (Khoo & Ainley, 2005).

Many research have been done to investigate attitude of students towards mathematics. Most of researchers (Farooq & Shah, 2008) (Mohamed & Waheed, 2011)(Ashby, 2009)(Belbase, 2013)(De Lourdes Mata, Monteiro, & Peixoto, 2012) agree that attitude towards mathematics play an important role in the process of teaching and learning mathematics. In the long term, understanding and achievement of mathematics will be effected. From the work done by (Farooq & Shah, 2008) and (De Lourdes Mata et al., 2012), they indicate there are no difference on the attitude towards mathematics among gender. Literature done by (Mohamed & Waheed, 2011) found that there are few factors that have been categorized into three different groups which affect students' attitude towards mathematics. The first factor are factors related to the students for example students' self-efficacy and concept, extrinsic motivation and their own experiences. The second factor includes factors about school, teacher and teaching. While the third factor involves factors associated with students' surroundings for example home and society.

Mathematics anxiety is considered as one of serious problem that affect mathematics education (Yaratan, & Kasapoğlu 2012) (Zakaria, Zain, Ahmad, & Erlina, 2012) (Belbase, 2013). In a study done by (Zakaria et al., 2012), they have found that there are differences exist among secondary school students in terms of level of mathematics anxiety. Level of mathematics anxiety at the end will affect students' achievement in mathematics. Higher anxiety toward mathematics have made students avoid and refuse to attend meaningful learning process and eventually they fail in exams (Yaratan & Kasapoğlu, 2012). Researchers come to a conclusion that teaching and learning strategies need to be enhanced to help students overcome their mathematics anxiety.

One of the main priorities in education policy is investments on infrastructure. Infrastructure in educational institutions such as ICT infrastructure which includes computers, whiteboards, connectivity, software and etc are very important as nowadays teaching and learning can be done via online. As time flies towards globalization era, internet technology and social media grow sophistically and enable virtual interaction between teachers and students. Hence, there are many learning model anticipates the usage of internet have been developed. One of the learning model used nowadays is blended learning model which is the combination of an e-learning system and traditional approach of teaching (Lin, 2017). At first, a teacher will conduct

classes and after the students have grabbed basic fundamentals of the courses, the students shall proceed to learn via online. This kind of teaching approach need a very good infrastructure and fast network. Using efficient support system can boost up positive attitude towards mathematics (Al-Nefaie, 2015)(Zuljan & Janez Vogrinc, 2010).

Learning in small groups have positive impact towards students' performance, knowledge development, thinking skills, social skills and course satisfaction in some of key areas (Davidson & Major, 2014). Some of the research done by (Samuelsson, 2010) (Curtis, 2009)(Davidson & Major, 2014) indicate that peer collaboration have affected the students' progress in quantitative concepts. In research done by (Curtis, 2009), they found that, longer period of time need to be given to the group for them to work together as they perform better. Gillies and Boyle (Gillies & Boyle, 2010) indicate that teachers have reflected positively about cooperative learning. Cooperative learning should be used more widely as they said students responded well to their own group. However, in order to implement peer collaboration effectively, it require commitment from teachers and teachers need to be trained with skills as the tasks are complex and challenging.

With the belief that attitude plays an important role in learning mathematics (Neala, 1969), it becomes an important research area in mathematics education due to several reasons. Attitude can explain the reasons of many behaviors as well as it reflects persons' perception towards one particular subject. Apart from that, attitude give clues about unconscious determinants of the behaviors and a basis for all social behavior. Hence, due to these reasons, then further research that seeks to understand the attitude of students towards mathematics need to be done. This will aid us to strategize future movement to increase mathematics achievement among TVET students. The objective of this paper is to examine the factor structure of technical students' attitudes towards mathematics.

Methodology

The study used a quantitative research method. A total of 278 technical university students from three faculties participated in this study. The respondents were Diploma and Degree students in one of the technical university in Malaysia. The study concentrated on collecting and analyzing data to examine the factor structure of technical students' attitudes towards mathematics. This study was using questionnaire survey, The Students Attitude Survey (SAS) developed by (Brookstein, Hegedus, Dalton, Moniz, & Tapper, 2014) for data collection. SAS was used to measure technical university students that participate in mathematics classes about their attitudes and beliefs in mathematics. They also was measured about their views on sharing ideas with peers. The questionnaire consists of two parts; demographic backgrounds and the 26 items that measure students' attitude toward mathematics. The respondents were requested to give responses on a 5 point Likert scale where scale 1, 2, 3, 4, 5 is for strongly disagree, disagree, neutral, agree and strongly agree, respectively. The questionnaire was designed using items from various instruments that have been established. Items selected are related to affect and attitude towards mathematics, enjoyment of mathematics, motivation

and valuing mathematics. Addressing positivity or negativity terminology have been used in this questionnaire to attend to affective-response behavior. The descriptive statistics and factor analysis were used to analyze the data.

Research Finding

The result of the data analysis reports a demographic background of the respondents and reports the findings on the factors extracted from factor analysis procedure. The factors extracted represents students' attitude towards mathematics among the technical students. Table 1 shows a demographic background of the respondents.

Table 1 Descriptive Statistics of Demographic Background

		Frequency	Percentage
Gender	Male	127	45.7
	Female	151	54.3
Ethnics	Malay	216	77.7
	Chinese	49	17.6
	Indian	2	.7
	International/others	11	4.0
Technology Faculty	Faculty of Information and Communication Technology	100	36.0
	Faculty of Technology Management and Technopreneurship	112	40.3
	Faculty of Engineering Technology	66	23.7
Entrance To University	Diploma	90	32.4
	Matriculation	98	35.3
	Sijil Tinggi Pelajaran Malaysia (STPM)	90	32.4
Current Level of Education	Degree	195	70.1
	Diploma	83	29.9
Have You experience learning mathematics using any computer technology?	No	74	26.6
	Yes	204	73.4

A total of 278 respondents was volunteered to be as a sample in this study. From the total, 45.7 % was male students and 54.3% was female students. Majority of the respondents were Malays students, which was 77.7%, followed by Chinese (23.7%), International students (4%) and Indian (0.7%).

This study only involved technology faculties at one of the technical university in Malaysia, and the proportion of volunteers to be respondents were as followed; 40.4% from Faculty of Technology Management and Technopreneurship, 36% from Faculty of Information and Communication Technology, and the rest 23.7% were from Faculty of Engineering Technology. The proportion of entrance to the university were almost the same, i.e. 35.3% were enter the university after completed their matriculation course, 32.4% were enter university based on their diploma qualification and 23.7% were enter the university based on their Sijil Tinggi Pelajaran Malaysia (STPM) result. Currently, the respondents were studying in a diploma level (29.9%) and degree level (70.1%). Majority of them were having an experience using technology in learning mathematics (73.4%) and also 26.6% of them were not having any experiences in learning mathematics using any technology.

The study used confirmatory factor analysis to validate the hypothesized factor structure of The Student Attitude Survey (SAS).

Table 2: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.766
Bartlett's Test of Sphericity	Approx. Chi-Square	2073.258
	df	325
	Sig.	.000

The Bartlett test of sphericity and Kaiser-Meyer-Olkin test were performed to support the use of factor analysis for the data. As shown in Table 2, Bartlett's test of sphericity was significant ($\chi^2 = 2073.258$; df = 325, $p < 0.000$) and the KMO index of sampling adequacy was 0.766. It is suggested that if the Bartlett's test of sphericity is significant, and if the Kaiser-Meyer-Olkin measure is greater than 0.6, then factorability is assumed [19]. Thus, based from the results, it is appropriate to proceed with Factor Analysis to examine technical students' attitude towards mathematics.

Table 3 displays the total variance explained at four stages for examine technical students' attitude towards mathematics. Four factors were extracted with eigenvalues greater than 1.

International Journal of Academic Research in Business and Social Sciences
Vol. 7, Special Issue - 4th International Conference on Educational Research and Practice 2017
ISSN: 2222-6990

Table 3: Total Variance Explained

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.729	18.187	18.187	4.729	18.187	18.187	4.289	16.496	16.496
2	2.947	11.335	29.521	2.947	11.335	29.521	2.638	10.145	26.642
3	2.098	8.069	37.590	2.098	8.069	37.590	2.555	9.826	36.467
4	1.484	5.709	43.300	1.484	5.709	43.300	1.776	6.832	43.300
Extraction Method: Principal Component Analysis.									

Table 4 shows the rotated factor matrix for the questionnaire. Tabachnick and Fidell [28] stated variable with factor loadings more than 0.45 were chosen in this study because loadings equals to 0.45 is considered average, whereas loadings 0.32 is considered less good.

Table 4: Rotated Factor Matrix

Rotated Component Matrix[a]				
	Component			
	1	2	3	4
1 I think mathematics is important in life	.660			
2 I learn more about mathematics when I working on my own	.496			
3 I do not like to speak in public when doing mathematics		.408		
4 I prefer working alone rather than in groups when doing mathematics	.266	.186	.153	
5 I get anxious in school when learning Mathematics		.443		
6 I learned mathematics more from talking to my friends than from listening to my teacher			.455	
7 Technology can make mathematics easier to understand			.629	

International Journal of Academic Research in Business and Social Sciences
Vol. 7, Special Issue - 4th International Conference on Educational Research and Practice 2017
ISSN: 2222-6990

8 Hand phones are an important technology in my life			.415	
9 I like my own space outside university on the majority of the			.351	
10 I enjoy being part of large groups outside classroom			.361	
11 I do not participate in many group activities outside classroom		.609		
12 I do not like attending mathematics lectures		.529		
13 I like math	.862			
14 I feel confident in my abilities to solve mathematics problem	.766			
15 In the past, I have not enjoyed math class		.349		
16 I receive good grades on math tests and quizzes	.599			
17 When I see a math problem, I am nervous		.534		
18 I am not eager to participate in discussions that involve mathematics		.519		
19 I enjoy working in groups better than along in math class				.646
20 I like to go to the board or share my answers with peers in				.393
21 I enjoy hearing the thoughts and ideas of my peers in math class				.564
22 Mathematics interests me	.841			
23 I sometimes feel nervous talking out-loud in front of my class		.411		
24 I enjoy using a computer when learning mathematics			.692	
25 When using technology for learning mathematics, I feel like			.614	
26 I am not comfortable using technology in math class		.676		
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.[a]				
a. Rotation converged in 8 iterations.				

Component Transformation Matrix				
Component	1	2	3	4
1	.914	-.225	.320	.107
2	-.080	.716	.649	.246
3	.371	.626	-.447	-.521
4	.142	.214	-.526	.811

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

There were four components extracted from the factor analysis. The components represent the student's attitude towards Mathematics. The first attitude belongs to a group that having positive and motivated towards Mathematics subject. Basically, there is not much problem arise by this group of students and they capable to catch up Mathematics syllabus that structured by the faculty.

The second components extracted from factor analysis was anxiety towards Mathematics subject. Mathematics lecturers should aware on this anxiety issue among students so that further action can be planned to this particular group. This is important for both parties in order to have effective knowledge transfer in producing better expert in technical areas. Thus, further research can be maneuver to study on the challenges and effective solutions for this particular group.

Having efficient support system was identified as a third component on the TVET students' attitude towards Mathematics. The support system for students to learn Mathematics better can be come from human itself and also human computer interaction. Students receive human support system from their friends and study group outside Mathematics classroom, meanwhile students receive human computer interaction support system from the computer, hand phones, and technology tools. Students who required support system are likely to enjoy learning using technology tools compared to the other loading factors extracted.

The fourth components extracted was collaboration among their peers in learning mathematics. They enjoy working in groups and hearing the thought and ideas of their peers when they study Mathematics. They also like to go to the board for sharing their answer with their peers. However, there was one item which is 'I prefer working alone rather than in groups when doing mathematics', did not show good reliability in the fourth components.

With the finding, it may benefits the technical students, the Mathematics lecturer who are teaching at the technical institutions, as well as the institution itself.

The students basically can understand themselves better when discuss about their ability in learning Mathematics. Those who are having positive attitude and motivated in learning Mathematics may help those who are having anxiety towards Mathematics by provide or

become support systems and doing some collaborate among them in a same group. This could triggered interest among them and does not left out the group who are having trouble in learning Mathematics.

Mathematic lecturers should aware on the each attitude criteria formed by students when learning Mathematics. This can guide the lecturers to identify the right and effective ways to motivate students on learning more about Mathematics. By doing so, the students able to grasp learning objective of each Mathematics topics faster, deeper and more enjoyable.

The technical institutions also can play their part with the findings that reveal in this study. Since students required to have support systems in both human and computer interaction, as well as collaboration and sharing thought among students in Mathematics discussion, the institution may provide better setting and facilities in term of technology and vibrant environment.

Discussion

The finding benefits to the technical students, the Mathematics lecturer who are teaching at the technical institutions, as well as the institution itself. The students basically can understand themselves better when discuss about their ability in learning Mathematics. Those who are having positive attitude and motivated in learning Mathematics may help those who are having anxiety towards Mathematics by provide or become support systems and doing some collaborate among them in a same group. This could triggered interest among them and does not left out the group who are having trouble in learning Mathematics.

Mathematic lecturers should aware on the each attitude criteria formed by students when learning Mathematics. This can guide the lecturers to identify the right and effective ways to motivate students on learning more about Mathematics. By doing so, the students able to grasp learning objective of each Mathematics topics faster, deeper and more enjoyable.

The technical institutions also can play their part with the findings that reveal in this study. Since students required to have support systems in both human and computer interaction, as well as collaboration and sharing thought among students in Mathematics discussion, the institution may provide better setting and facilities in term of technology and vibrant environment.

References

Abdul Gafoor, K., & Sarabi, M. (2015). Relating Difficulty in School Mathematics to Nature of Mathematics : Perception of High School Students from Kerala. *National Conference on Mathematics Teaching-Approaches and Challenges*, 1–16. Retrieved from http://files.eric.ed.gov/fulltext/ED566898.pdf

Al-Nefaie, S. (2015). *Investigating factors influencing students ' attitude and performance when using web-enhanced learning in developing countries : The case of Saudi Arabia*. Brunel University.

Anthony, G., & Walshaw, M. (2009). Characteristics of Effective Teaching of Mathematics: A View from the West. *Journal of Mathematics Education*, *2*(2), 147–164.

Ashby, B. (2009). Exploring children's attitudes towards mathematics. *Proceedings of the British Society for Reasearch into Learning Mathematics*, *29*(1), 7–12.

Belbase, S. (2013). Images, Anxieties, and Attitudes toward Mathematics. *International Journal of Education in Mathematics Science and Technology*, *1*(4), 230–237.

Brookstein, A., Hegedus, S., Dalton, S., Moniz, R., & Tapper, J. (2014). Measuring student attitude in mathematics classrooms, (May), 20.

Curtis, S. J. (2009). Improving Achievement and Attitude Through Cooperative Learning in Math Class, 64. Retrieved from http://digitalcommons.unl.edu/mathmidactionresearch

Davidson, N., & Major, C. H. (2014). Boundary Crossings : Cooperative Learning , Collaborative Learning , and Problem-Based Learning, *25*, 7–55.

De Lourdes Mata, M., Monteiro, V., & Peixoto, F. (2012). Attitudes towards Mathematics: Effects of Individual, Motivational, and Social Support Factors. *Child Development Research*, *876028*(10). http://doi.org/10.1155/2012/876028

Farooq, M. S., & Shah, S. Z. U. (2008). Students' Attitude Towards Mathematics. *Pakistan Economic and Social Review*, *46*(1), 75–83.

Gamble, J. (2013). Why improved formal teaching and learning are important in technical and vocational education and training (TVET). *Revisting Global Trends in TVET: Reflections on Theory and Practice*, 204–238.

Gillies, R. M., & Boyle, M. (2010). Teachers' reflections on cooperative learning: Issues of implementation. *Teaching and Teacher Education*, *26*(4), 933–940. http://doi.org/10.1016/j.tate.2009.10.034

Jackson, A. (2016). The latest ranking of top countries in math, reading, and science is out — and the US didn't crack the top 10. Retrieved from http://www.businessinsider.my/pisa-worldwide-ranking-of-math-science-reading-skills-2016-12/?r=US&IR=T#iTeZyKbm8wtW4x1y.97

Karagiannakis, G., Baccaglini-Frank, A., & Papadatos, Y. (2014). Mathematical learning difficulties subtypes classification. *Frontiers in Human Neuroscience*, *8*(February), 57. http://doi.org/10.3389/fnhum.2014.00057

Kashefi, H., Ismail, Z., Yuso, Y. M., & Rahman, R. A. (2011). Promoting Creative Problem Solving in Engineering. *3rd International Congress on Engineering Education ICEED*, 8–13. http://doi.org/10.1109/ICEED.2011.6235350

Lin, Y.-W. (2017). The Effect of Blended Learning in Mathematics Course. *EURASIA Journal of Mathematics, Science and Technology Education*, *13*(3), 741–770. http://doi.org/10.12973/eurasia.2017.00641a

Majid, A., Nosrat, R. & Fariba, M. (2010). Computer-assisted instruction and student attitudes towards learning mathematics. *Education, Business and Society: Contenporary Middle Eastern Issues,* 3 (1), pp. 6-14.

Mahazir I., I., Norazah, M. N., Ridzwan, C. R., & Rosseni, D. (2013). The Acceptance of AutoCAD Student for Polytechnic on Mobile Learning. *Procedia - Social and Behavioral Sciences*, *102*(Ifee 2012), 169–176. http://doi.org/10.1016/j.sbspro.2013.10.730

Mohamed, L., & Waheed, H. (2011). Secondary Students' Attitude towards Mathematics in a Selected School of Maldives. *International Journal of Humanities and Social Science*, *1*(15), 277–281.

Office of the Chief Scientist. (2014). *Science, Technology, Engineering and Mathematics: Australia's Future*. *Septiembre*. Australian Government, Canberra. Retrieved from http://www.chiefscientist.gov.au/wp-content/uploads/STEM_AustraliasFuture_Sept2014_Web.pdf

Othman, H., Asshaari, I., Tawil, N. M., Ismail, N. A., Nopiah, Z. M., & Zaharim, A. (2012). Analysis on Mathematics Fundamental Knowledge for Mathematics Engineering Courses based on a Comparative Study of Students' Entry Performance. *Procedia - Social and Behavioral Sciences*, *60*(0), 365–371. http://doi.org/http://dx.doi.org/10.1016/j.sbspro.2012.09.392

Samuelsson, J. (2010). The Effect Of Peer Collaboration On Children ' s Arithmetic And Self-Regulated Learning Skills. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education*, *4*(2), 130–153.

Suan, J. S. (2014). Factors Affecting Underachievement in Mathematics. *Global Summit on Education GSE 2014*, *2014*(March), 4–5. Retrieved from http://worldconferences.net/proceedings/gse2014/toc/papers_gse2014/G 010 - JOEFEL_Factors Affecting Underachievement in Mathematics_read.pdf

Tambychik, T., & Meerah, T. S. M. (2010). Students' difficulties in mathematics problem-solving: What do they say? *Procedia - Social and Behavioral Sciences*, *8*, 142–151. http://doi.org/10.1016/j.sbspro.2010.12.020

Tarver, T. (2015). The Retention Rate of Students of Mathematics Education. *Procedia - Social and Behavioral Sciences*, *177*(July 2014), 256–259. http://doi.org/10.1016/j.sbspro.2015.02.327

Yaratan, H., & Kasapoğlu, L. (2012). Eighth Grade Students' Attitude, Anxiety, and Achievement Pertaining to Mathematics Lessons. *Procedia - Social and Behavioral Sciences*, *46*, 162–171. http://doi.org/10.1016/j.sbspro.2012.05.087

Zakaria, E., Zain, N. M., Ahmad, N. A., & Erlina, A. (2012). Mathematics anxiety and achievement among secondary school students. *American Journal of Applied Sciences*, *9*(11), 1828–1832. http://doi.org/10.3844/ajassp.2012.1828.1832

Zuljan, M. V., & Janez Vogrinc. (2010). *Facilitating Effective Student Learning through Teacher Research and Innovation*. *Advances in Mathematics*. Faculty of Education, University of Ljubljana, Slovenia. http://doi.org/10.1016/S0001-8708(11)00086-7