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PROOF PROFILE OF STUDENTS WITH VARIOUS ADVERSITY QUOTIENTS IN TRIGONOMETRY

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Abstract

Proof is information that show something is true. According to Weber (2004), there are three kinds of proof production, such as procedural, syntactic and semantic proof production. Each student's approach may not fall into just one category of proof production. Meanwhile, based on Adversity Quotient that divide student based on their adversity, it possible that there is a difference in students proofing process. *Adversity Quotient* consist of three categories, they are climber camper and quitter. This research is a descriptive-qualitative research. Subjects in this research consist of three students with climber, camper, quitter category of adversity quotient. This research instruments consist of Adversity Response Profile (ARP), Mathematical Ability Test, Problems of Trigonometric identities, and Interview Transcript. The result of this research show that subject climber does the proof of all problems using syntactic proof production. Subject climber also does the semantic proof production It is appropriate with the characteristics of climber in solving problem. Subject camper does the proof of all problems using syntactic proof. Subject camper does not check her work, because subject camper feels that is correct. It is appropriate with the characteristics of camper in solving problem. Meanwhile, subject quitter does the proof of all problems using procedural proof production because in proof profile of subject quitter depends on procedure and give up for all problems. Subject quitter does not feel confident with their ability. It is appropriate with the characteristics of quitter in solving problem.

Keywords: proof, proof profile, adversity quotient, and trigonometry

INTRODUCTION

Education is conscious and structured effort to realize good condition of learning process so that students actively develop their potentials to have self-control, personality, intellegence, good character and the other skills that needed by theirselve, society, nation and country. In indonesia, education refers to the curriculum that created by the ministry of education and culture. In the education world, the basic of sciences and technology is mathematics. Competencies can be developed into problems. Based on Polya, there are two types of problem, problem to find and problem to prove.

In the Indonesian mathematics learning, proof is one of aspects to consider. It can been seen from the mathematics' learning objectives in Permendikbud 2016 No. 21 that one of them is showing logics, critics, analytic, creative, meticulous, responsible, responsive and do not give up in solving the problems. One of proofs problems in senior high school is trigonometry.

Trigonometry has many benefits in life, however, many students like to avoid the trigonometry material. It is showed in the result of a national exam in 2015, the absorption of mathematical competence of trigonometry is only 60.81% (Balitbang, Kemendiknas). Although in national exam do not contain spesific indicator of proving identity of trigonometry, the indicator of proving the identity of trigonometry indirectly shown in the other sub-matery of trigonometry.

By looking at the low average score of trigonometry material in national examinations, it indicates students have difficulties in manipulating formula of trigonometry. Therefore, teacher must know about proof profile of students when they are manipulating the formula. Knowing students' proof profile needs an accurate information about the proof profile that they use and how previous knowledge that they have.

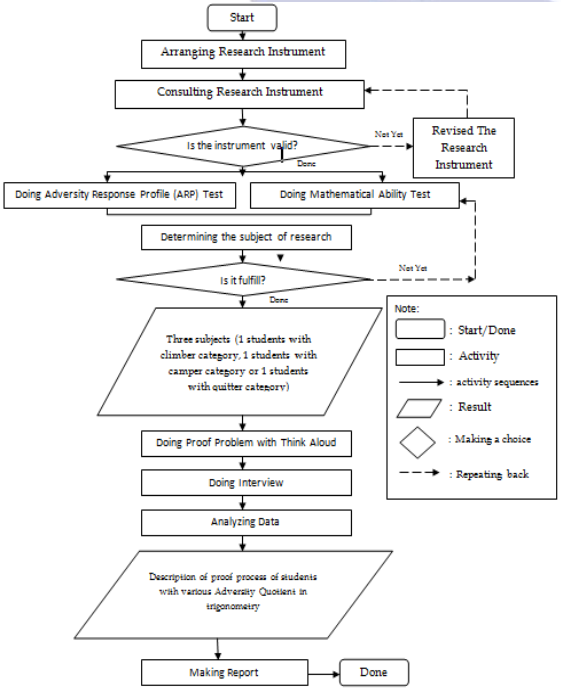
Grouping students into types of adversity quotient based on idea about students' differences that can be seen easily through students' behavior, includes the students' performance motivation to study, empowerment, creativity, productivity, learning, energy, hope, happiness and joy, emotional health, physical health, persistance, resilience, improvement over time, attitude, longevity and response to change. Therefore, adversity quotient suitables to know students' proof profile.

This research seeks to describe those strategies that are involved specifically in the profile of proof writing. The framework for this study was based on the larger categories of proof-writing profile defined by Weber (2004) that classified proof profile into three categories: procedural, syntactic, and semantic profiles.

This research expands on these definitions by adding to the description of students with various adversity quotient strategies involved in each of these types of proof productions. That is, the researcher seeks to describe the detailed profile used during the proof-writing profile in order to more completely understand this profile.

METHOD

This research method is a descriptive-qualitative that used to know proof profile of students with various adversity quotient in trigonometry. This research was done in three class of one senior high school in Sidoarjo, Indonesia on December 11th and 19th, 2017. There are three subjects in this research. Design of this research can be seen in the following figure.



The instruments that use for this research, are:

1. Adversity Response Profile (ARP) is an instrument that contains some problems that will be answered by students to know the categories of each students based on adversity quotient.
2. Mathematical Ability Test use to control mathematical ability of research subjects, in order to the subject have equivalent ability of mathematics.
3. Proof Problem of Trigonometric Identities is a test of solving proof problem of trigonometric identities.
4. Interview Guidance to gain information about proof profile of students in trigonometry.

There are three steps of this research. First, researcher gave Adversity Response Profile (ARP) to students in three classes to categorize students based on their adversity. Second, researcher gave mathematical ability test to look for subject who is have equivalent mathematical ability. Third, students do the proof of trigonometric identities with and continue it with interview process to know proof profile of students in trigonometry.

The analysis data to find subjects is categorizing students based on the adversity quotient, which students with scores ARP greater or equals to 166 categories as climber, students with scores ARP between 95 and 134 categories as camper, and students with scores ARP lower or equals to 59 categories as quitter. Then, students do the mathematical ability in order to get subject that have equivalent mathematical ability.

The analysis data to know proof profile of subjects is by considering from subjects answer sheet and the interview process of students. The analysis proof profile is based on Weber proof production, they are procedural, syntactic, and semantic proof production.

RESULTS AND DISCUSSIONS

This research was done in Senior High School 1 Taman Sidoarjo on December 11th and 19th, 2017 in three classes. First day, students did adversity response profile and mathematical ability test.

Data Result of Mathematical Ability Test and ARP

Based on this result, students group into category of adversity. From 102 students, it choose 3 students as the subjects of this research, one from the climber category, one from camper category, and one from quitter category. It can be seen as in the following table.

Table 1. Research Subjects

Adversity Quotient	Score of AQ	Score of mathematical ability test	Code of Subjects
Climber	166	100	MRS
Camper	134	100	ZB
Quitter	59	100	IW

The researcher's way to choose subject is choosing students who have the highest score in each category of adversity quotient and they have equivalent mathematical ability. The students' mathematical ability called equivalent when the interval score of each subject less than or equal to 5 in the scale of 100. In the other hand, the way to choose subject is knowing the subject who has good ability in communication in order to make the researcher do interview easily.

Data of Doing Proof Problem and Interview

Proof of trigonometric identity problem consists of 4 problems. Subjects did the proof of trigonometry identity problem. After that, subjects are interviewed one by one.

Proof Profile of Subject Climber (H) in Trigonometry

MRS is a student of XI science 2. He is a smart students who has good ability communication and attitude. MRS is a thinkers student who worked well with proofs involving careful notation and the argument in each step. He was able to think quickly and understand all questions that were presented to him. His proofs were accurate, concise, for the most part, as well as being organized. MRS said the argument in each step of his work without doubt, nor did he always continued his work through he felt confidence in a while. His plan in overall were not always shown, his work shown a clear understanding what was needed to form a proof.

MRS understand the questions first before he proving the trigonometric identities, this was indicated by he paid attention to the question. It was appropriate with his category *climber* that he had, he wasn't careless. Then, the subject *climber* shown correctly the purpose of all questions on based on his understanding.

His work on those questions was structured and fixed, the most important part was focused without following into unrelated calculation or thought. MRS was turning his thoughts quickly after trying many thought that did not yield in the headway to his proof. He did the plan to proof with relating the step to proof with the knowledge that he had.

Based on Chapter 2, each students' approach may not use just one category. The analysis proof process of the subject *climber* in proving the identity of trigonometry.

1. **Procedural Proof Production (PrP)**

   Subject climber (MRS) construct a proof of all question of trigonometric identities by manipulating the pythagorean identities, manipulating basic trigonometry identity and performing algebraic manipulation, it includes, exponential, expansion, factorization, cancellation, find a common denominator, multiply the numerator and denominator by a conjugate, use an additional trigonometric formula, and use multiplication property. There is no spesific steps in proofing all of trigonometric identities question. He believes will yield a valid proof in the first step he chosen. He worked aloud and explained the reason of each step of his work.

   Subject climber (MRS) produce a valid proof of trigonometric identities and he could explain what their proof meants. He explain if the question "buktikan identitas trigonometri", means the proof of trigonometric identities will be verified when either sides are exactly same. Subject climber (MRS) perfom algebraic manipulation in trigonometric identities. He manipulated one side of the proposed identity until it becomes the other side of the identity.

   Based on the explanation PrP above, it can conclude that he had abilities to perform algebraic manipulation, but he constructs a proof not by applying spesific procedure. Not only believes will yield a valid proof, but also MRS could explain what their proofs meant.

2. **Syntactic Proof Production (SyP)**

   Overall, MRS manipulating correctly the one side of the proposed identity until it become the other side of identity in a logically permissible way. He worked aloud and the reason of each step of his work shown on the interview transcript of all problems. He completed the proof of trigonometric identities of all question by manipulating the variables of trigonometry to his desired result. It is proven that the researcher didn't give clue to MRS in the process of manipulating.

   Based on the explanation SyP above, it can conclude that he complete the proof not only in manipulating correctly the trigonometry identities one to another trigonomtry identities in a logically permissible way but also manipulating the trigonometry identities to his desired result.

3. **Semantic Proof Production (SeP)**

   Overall, MRS understand why a step of proof is true by examining representations of the trigonometric identities. He worked aloud and he understand the reason of each step of his work. It can be seen on the interview transcript of his work of all questions. He said the logic reason, he didn't use his intuitive argument as a basis for constructing a proof in trigonometric identities.

   Based on the explanation SeP above, it can conclude that he understand the reason of each step of his work and the reason is logic, because the question of trigonometric identities is direct proof.

   Based on the analysis of proof process above, researcher know that MRS doing all questions using syntactic proof production in his first approach, because ZB manipulated correctly the trigonometric identities one to another trigonometric identities in a logically permissible way to his desired result.

Proof Profile of Subject Camper (M) in Trigonometry

ZB was a quiet student who worked well with proofs through she didn't confident with her work. She satisfied

easily when she had worked the first answer. She was able to think quickly and understand most questions that were presented to her. Her proofs were accurate, concise, for the most part, as well as being organized. ZB said the argument in each step of herwork without doubt.

Her plan in overall were not always shown, her work shown a clear understanding what was needed to form a proof. In his interviews, ZB understand the questions first before she proving the trigonometric identities, it was indicated by she paid attention to the question. ZB satisfied easily when she did the proof. It was appropriate with her category *camper* that she had, she satisfied easily.

Her work on those questions was structured and fixed, the most important part was focused without following into unrelated calculation or thought. ZB was turning her thoughts quickly after trying many thought that did not yield in the headway to her proof. She did the plan to proof with relating the step to proof with the knowledge that she had. She believed that other methods were done in a correct ways and she convinced that her result is correct.

Based on chapter 2, each students' approach may not use just one category. This is the analysis proof process of the subject *camper* in proofing the trigonometric identities.

1. Procedural Proof Production (PrP)

Subject *camper* (ZB) constructs a proof of all trigonometric identities by manipulating pythagorean identities, manipulating basic trigonometry identity and performing algebraic manipulation, it includes exponential, expansion, cancellation, factorization, find a common denominator, multiply the numerator and denominator by a conjugate, use an additional trigonometric formula and using distributive multiplication.

There is no spesific steps in proofing all of trigonometric identities question. She needs some clue from researcher to do the questions. At the first, she didn't believe with her self when she started to proof, then researcher convinced her that's okay if something goes wrong. She satisfied easily with her answer and she didn't want to do the other alternative answer. She worked aloud and explained the reason of each step of her work.

Subject *camper* (ZB) produce a valid proof of trigonometric identities and she could explain what their proof meants. She explain if the question "buktikan identitas trigonometri", means the proof of trigonometric identities will be verified when either sides are exactly same, but she didn't explain clearly the meants of the proof. She only said that the left side change into the right side or the right side change into the left side, but she prefer to change the left side. Subject *camper* (ZB) perform algebraic manipulation in trigonometric identities. She manipulated one side of the proposed identity until it becomes the other side of the identity.

Based on the discussion above, it can conclude that she had abilities to perform algebraic manipulation, but she construct a proof not by applying spesific procedure. Not only believes will yield a valid proof, but also ZB could explain what her proofs meant.

2. Syntactic Proof Production (SyP)

ZB manipulating the one side of the proposed identity until it become the other side of identity in a logically permissible way, but she needs help from the researcher to choose the first step to proof. She worked aloud and the reason of each step of her work shown on the interview transcript of all questions. She completed the proof of trigonometric identities of all questions by manipulating the variables of trigonometry to her desired result, but she needed some clues from researcher what is the first step to proof and always confirmed whether her step is correct or not.

Based on the discussion above, it can conclude that she complete the proof not only in manipulating correctly the trigonometry identities one to another trigonometry identities in a logically permissible way but also manipulating the trigonometry identities to her desired result.

3. Semantic Proof Production (SeP)

Overall, ZB understand why a step of proof is true by examining representations of the trigonometric identities, although she was helped by researcher. She worked aloud and he understand the reason of each step of his work. It can be seen on the interview transcript of her work of all questions. She said the logic reason, she didn't use his intuitive argument as a basis for constructing a proof in trigonometric identities.

Based on the discussion above, it can conclude that she understand the reason of each step of her work and the reason is logic, because proofing the trigonometric identities is direct proof.

Based on the analysis of proof process above, researcher know that ZB doing all questions using syntactic proof production in her first approach, because ZB manipulated correctly the trigonometric identities one to another trigonometric identities in a logically permissible way to her desired result.

Proof Process of Subject Quitter (L) in Trigonometry

IW was a humble student who worked worst because of his unconfident. Actually, he could do the question well, but from the beginning, he unconfident with his work. The effect is worked well with proofs involving careful notation and the argument in each step. He was able to think quickly and understand most questions that were presented to him. His proofs were accurate, concise, for the most part, as well as being organized. IW said the

argument in each step of his work without doubt, nor did he always continued his work through he felt confidence in a while. His plan in overall were not always shown, his work shown a clear understanding what was needed to form a proof.

In his interviews, IW didn't understand the questions before he proving the trigonometric identities, he always said that he gave up to do the question from the researcher, but the researcher gave spirit to the subject to do the question. With the help of the researcher, the subject quitter do the question. It was appropriate with his category *quitter* that he had, he almost gave up with all of question

Based on chapter 2, each students' approach may not use just one category. This is the analysis of proof process of the subject *quitter* in proving the trigonometric identities.

1. Procedural Proof Production (PrP)

Subject *quitter* (IW) construct a proof of trigonometric identities all problems. by manipulating pythagorean identities and performing algebraic manipulation, it includes, factorization, find a common denominator, multiply the numerator and denominator by a conjugate, use an additional trigonometric formula. There is no spesific steps in proofing all of trigonometric identities question. He didn't believes will yield a valid proof in the first step he chosen. He always gave up when he saw the question. He always asked to researcher what is the first step to do the questions. He did all questions without thought deeply. As the consequences, many scratchs in his paperwork. He worked aloud and explained the reason of each step of his work.

Subject *quitter* (IW) produce a valid proof of trigonometric identities with the help from researcher but he couldn't explain what their proof meants. Subject *quitter* (IW) perform algebraic manipulation in trigonometric identities. He manipulated one side of the proposed identity until it becomes the other side of the identity, but he need help from the researcher. IW didn't understand clearly the question from the beginning. He confused what the first step he took to do this question. He said that he gave up before he tried to do this question. The researcher gave clue which variable that can be changed.

Based on the discussion above, it can conclude that he couldn't finish the proof of all trigonometric identities question without the researcher's help. He construct a proof by performing algebraic manipulation as the researcher's said. He did not convince with his work and he couldn't explain what his proof meants.

2. Syntactic Proof Production (SyP)

Overall, IW manipulating correctly the one side of the proposed identity until it become the other side of identity in a logically permissible way with the researcher's help in each step. He worked aloud and the reason of each step of her work shown on the interview transcript of all questions. He completed the proof of trigonometric identities by manipulating the variables of trigonometry to his desired result, but each step of his proof need help/need clue from the researcher, because he gave up when he read the question.

Based on the discussion above, it can conclude that he complete the proof in manipulating correctly the trigonometry identities one to another trigonometry identities in a logically permissible way and manipulating the trigonometry identities to his desired result but each step of his proof need help/need clue from the researcher, because at the first sight he read question, he gave up.

3. Semantic Proof Production (SeP)

IW didn't fully understand why a step of proof is true by examining representations of the trigonometric identities. He needed full of help from the researcher. He couldn't do the proof of trigonometric identities question if he didn't get clue from the researcher. He worked aloud and he understand the reason of each step of his work. It can be seen on the interview transcript of his work of all question. He said the logic reason, he didn't use his intuitive argument as a basis for constructing a proof in trigonometric identities. IW needed clue from the researcher, in order to make him feel confident to say the reason for each step.

Based on the discussion above, it can conclude that he understand the reason of each step of his work and the reason is logic. Because proofing the trigonometric identities is direct proof, so it prefer use logic reason.

Based on the analysis of proof process above, researcher know that IW doing all questions using syntactic proof production in his first approach, because IW manipulated correctly the trigonometric identities one to another trigonometric identities in a logically permissible way to his desired result.

CLOSURE

Conclusion

Based on the analysis result and discussion, it can be concluded as follows.

1. Proof Process of Students with Climber Category in Trigonometry.

   Student construct a proof of all question of trigonometric identities by manipulating basic trigonometry identity and performing algebraic manipulation because there is no spesific procedure in proofing all question of trigonometric identities. Student believes will yield a valid proof in the first step he chosen and could explain what his proof mean.

Student manipulated correctly the one side of the proposed identity until it become the other side of identity in a logically permissible way. Student completed the proof of trigonometric identities of all question by manipulating the variables of trigonometry to his desired result. It is proven that the researcher didn't give clue to MRS in the process of manipulating.

Student understand why a step of proof is true by examining representations of the trigonometric identities. Student worked aloud and student understand the reason of each step of his work. Student said the logic reason, student didn't use his intuitive argument as a basis for constructing a proof in trigonometric identities.

Based on the analysis of proof process above, student do all questions using syntactic proof production in his first approach, because student manipulated correctly the trigonometric identities one to another trigonometric identities in a logically permissible way to his desired result.

2. ***Proof Process of Students with Camper Category in Trigonometry***

Student construct a proof of all question of trigonometric identities by manipulating basic trigonometry identity and performing algebraic manipulation because there is no spesific procedure in proofing all question of trigonometric identities. Student could explain what her proof meants. Student believes will yield a valid proof in the first step she chosen through student didn't confident when started to proof, then researcher convinced her that's okay if something goes wrong. She satisfied easily with her answer and she didn't want to do the other alternative answer.

Student manipulating the one side of the proposed identity until it become the other side of identity in a logically permissible way, but student needs help from the researcher to choose the first step to proof and always confirmed whether her step is correct or not.

Student understand why a step of proof is true by examining representations of the trigonometric identities. Student worked aloud and student understand the reason of each step of his work. Student said the logic reason, student didn't use his intuitive argument as a basis for constructing a proof in trigonometric identities.

Student understand why a step of proof is true by examining representations of the trigonometric identities, although she was helped by researcher. She worked aloud and he understand the reason of each step of his work. She said the logic reason, she didn't use his intuitive argument as a basis for constructing a proof in trigonometric identities.

Based on the analysis of proof process above, student do all questions using syntactic proof production in her first approach, because student manipulated correctly the trigonometric identities one to another trigonometric identities in a logically permissible way to his desired result.

3. **Proof Process of Students with Quitter Category in Trigonometry**.

Student construct a proof of all question of trigonometric identities by manipulating basic trigonometry identity and performing algebraic manipulation because there is no spesific procedure in proofing all question of trigonometric identities. Student didn't believes will yield a valid proof in the first step he chosen. Student always gave up when he saw the question. He always asked to researcher what is the first step to do the questions. He did all questions without thought deeply. As the consequences, many scratchs in his paperwork. Student couldn't explain what their proof meants.

Student manipulating correctly the one side of the proposed identity until it become the other side of identity in a logically permissible way with the researcher's help in each step. Student completed the proof of trigonometric identities by manipulating the variables of trigonometry to his desired result, but student need help from the researcher.

Student didn't fully understand why a step of proof is true by examining representations of the trigonometric identities. Student needed full of help from the researcher. Student couldn't do the proof of trigonometric identities question if student didn't get clue from the researcher. Student said the logic reason, student didn't use his intuitive argument as a basis for constructing a proof in trigonometric identities.

Based on the analysis of proof process above, student do all questions using syntactic proof production in his first approach, because student manipulated correctly the trigonometric identities one to another trigonometric identities in a logically permissible way to his desired result.

Suggestion

This research shows proof process of students with various adversity quotient (AQ) in trigonometry, but there are some suggestions as follows.

1. In the paper of trigonometry identities problems, there is no clue to write the reason for each step, so the subjects only speak the reason for each step and do not write it. There is indicator in semantic proof procedural production that analyze how subjects formally write proofs. It should be given some instruction to write the reason for each step in the paper of trigonometric identities problems. In order to, researcher can get deeply about the data of semantic proof production.
2. In the interview process, researcher need more experience in the interview that doing when students

work on the trigonometric identity problem given. Interview protocol that use in this research is designed to use in spontaneous interaction with the subject, but the amount of interaction and researcher's help for interview are inconsisten. Therefore, it need more correction on doing interview. As well as, how well the interview protocol fits actual situations which may occur

DAFTAR PUSTAKA

Algebraic Manipulation. *Brilliant.org.* Retrieved 18 49, January 5, 2018, from https //brilliant.org/wiki/algebraic-manipulation/

Algebraic Manipulation Identities. *Brilliant.org.* Retrieved 18 49, January 5, 2018, from https //brilliant.org/wiki/algebraic-manipulation-identities/

Aylar, Sahiner. 2013. *A* Study on teaching proof on 7th grade students. Procedia Social and Behavioral Sciences. (Online) (https //goo.gl/pbHqJe), download on 23 Oktober 2017)

Dewiyani. 2009. *Karakteristik Proses Berpikir Siswa Dalam Mempelajari Matematika Berbasis Tipe Kepribadian*. Disertation. Not Published. Surabaya Unesa Press.

Dirjen Dikti, 2014. *Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomer 59 Tahun 2014 tentang Kurikulum 2013 Sekolah Menengah Atas (SMA) (Lampiran).* Jakarta Kemendikbud.

Dirjen Dikti, 2006. *Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomer 22 Tahun 2016 tentang Standar Isi untuk Satuan Pendidikan Dasar dan Menengah (Lampiran).* Jakarta Kemendikbud.

Hakim, Lukman El. 2013. *Profil Proses Berpikir Siswa SMP dalam Menyelesaikan Masalah Matematika Ditinjau dari Perbedaan Tingkat Kecerdasan Emosi dan Gender.* Disertation. Not Published. Surabaya State University of Surabaya.

Muryati, 2016. *Proses Berpikir Siswa Dalam Menyelesaikan Masalah Pembuktian berdasarkan Tipe Keirsey Temprament Sorter*. Thesis. Not Published. Surabaya Unesa Press.

Pehkonen, Helsinki dkk. 1997. The-State-of-Art in Mathematical Creativity. (https //goo.gl/i5nMLx. download on 17 Mei 2017)

Peraturan Menteri Pendidikan dan Kebudayaan No.103 Tahun 2014 tentang Pembelajaran pada Pendidikan Dasar dan Pendidikan Menengah.

Schoenfeld, A. H. (1992). Learning to think mathematically problem solving, metacognition, and sense-making in matematics. New Yourk: MacMillan.

Siswono, Tatag Y. E. 2008. *Model Pembelajaran Matematika Berbasis Pengajuan dan Pemecahan Masalah untuk Meningkatkan Kemampuan Berpikir Kreatif.* Surabaya Unesa University Press. 136

Slavin, Robert E. 2006. Educational Psychology: Theory and Practice 8th Ed. United States of America Johns Hopkins University.

Soedyarto, Nugroho dan Maryanto. 2008. *Matematika untuk SMA dan MA Kelas XI Program IPA*. Jakarta The book center, Departemen Pendidikan Nasional.

Solso, Robert L., dkk. 2008. *Psikologi Kognitif Edisi Kedelapan*. (Alih Bahasa Mikael Rahardanto dan Kristianto Batuadji, S. Psi, M.A.) Jakarta Penerbit Erlangga.

Stoltz, G. Paul. 1997. Adversity Quotient Turning obstacle into opportunities. New York. (Online) (https //goo.gl/FAPqyp, not downloaded)

Sudarman. 2010. *Proses Berpikir Siswa SMP Berdasarkan Adversity Quotient (AQ) dalam Menyelesaikan Masalah Matematika*. Disertation. Not Published. Surabaya Unesa Press.

Susanto, Herry Agus. 2011. *Pemahaman Pemecahan Masalah Pembuktian Sebagai Sarana Berpikir Kreatif.* State University of Yogyakarta Prosiding Seminar Nasional Penelitian, Pendidikan, dan Penerapan MIPA, Faktultas MIPA. (Online). (https //goo.gl/bZPvhz), download on 27 September 2017)

Tim Penyusun. 2008. *Kamus Bahasa Indonesia*. Jakarta: Pusat Bahasa.

Widjajanti, Djamilah B. 2009. *Kemampuan Pemecahan Masalah Matematis Mahasiswa Calon Guru Matematika Apa Dan Bagaimana Mengembangkannya.* (Online) (https //goo.gl/gTNedj, Download on 27 September 2017)

Zang, Li Fang. 2002. Thinking Styles and The Big Five Personality Traits. (Online) Vol 22 Nomor 1. (https //goo.gl/hYccbS, diunduh pada 2 Oktober 2017)