The Analysis of Students’ Logical Thinking Ability and Adversity Quotient, and it is Reviewed from Cognitive Style

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Abstract. This type of research is qualitative research. The focus of this research is to determine the logical thinking ability and adversity quotient from the Students of Statistics batch III FMIPA UNM and reviewed from the cognitive style. The population in this research is all batch III students of Statistics Department at Universitas Negeri Makassar. The determination of the subject in this study is carried out by referring to the results of cognitive style tests. Based on the cognitive style test results, the students are grouped into two, namely: groups of students who have field-independent cognitive style (FI) and student group which has a field-dependent cognitive style (FD). The data collection on this study uses the main instrument, i.e. the researchers themselves, in addition to the main instrument is also used supporting instruments, namely: (1) the instrument to know the Students’ Cognitive Style: Group Embedded Figures Test (GEFT), (2) Instrument of Logical Thinking Ability (TOLT), and (3) Adversity Quotient instrument (AQ). Based on the result of analysis of research data in the previous chapter, some conclusions from the results of this study are: (1) the subject does not have the adequate readiness and lack of planning to solve the problem, (2) the subject does the trial process in applying the formula or process but the formula or process itself is not appropriate to solve the problem. To Adversity Quotient (AQ), camper category is dominant compared to other categories (quitter and climber) and none of the students have climber skill. From this camper category there are 16 students (84.2%) who have independent field cognitive style and the remaining 2 students (10.53%) have dependent field cognitive style. Students that are in camper category have little spirit, little initiative, and his/her efforts are sometimes less than the maximum. Students in camper category are students who are satisfied with the circumstances that he has achieved now and not willing to take too much risk.

1. Introduction
Mathematics is one of the knowledge which has a basic abstract object, which is based on truth consistency and arranged in a hierarchical manner and in accordance with the rules of logical reasoning. Mathematics as one of the knowledge with deductive reasoning that relies on logic in convincing the truth of an argument [1], [2]. In mathematics learning, the ability to think logically has an important role in understanding to solve math problems. The concept understanding which is not
supported by logical thinking ability will make students have a good intuition about a concept but are unable to solve a problem [3]. Thinking logically [4] is a process of thinking in a consistent way as an effort to obtain a conclusion. In some discussion, the term of logical thinking is often interchangeable with the term of logical reasoning, because both contain some common activities. In fact, the term of logical thinking has a broader range than logical reasoning. Logical thinking includes logical reasoning and other mathematical activities namely: understanding, connection, communication, and logical problem solving [5].

The regulation of the Minister of National Education Republic of Indonesia Number 23 in 2006, said that one of the standard competences from graduates for primary and secondary education unit is to demonstrate the ability to think logically, critically, and creatively. Logical thinking ability is the ability that is expected to be one of the abilities that need to be owned and developed by graduates from elementary and secondary education units. Logical thinking ability is also a very important ability to support the development of science and math learning. This is supported by the studies that connect the ability to think logically with other variables. Sumarmo [5], states that there is no association between logical thinking ability and creative thinking ability, and between the ability to think logically and creative thinking ability, as well as between the three abilities and the disposition of mathematical thinking, however there is an association between the ability to think logically and the ability to think critically. Swestyani [6] stated that the application of the discovery learning can improve the ability to think logically. Fitriana [7] research shows that logical thinking ability in mathematics with medium category and mathematics learning outcomes with medium category, so the ability to think logically has a direct insignificant effect to learning outcomes with 52% confidence level.

Each student must have different abilities and potentials, Stoltz groups people into 3 (three) AQ categories, namely; quitter (low AQ), camper (medium AQ), and climber (high AQ) [8]. Students who belong to quitter tend to stay away from problems, when they see the difficulties, they will choose to retreat, and do not dare to face the problem. Camper shows that children who do not want to risk too much and feel satisfied with the condition or state that has been achieved. While the climber category welcomes the challenge, motivates themselves, have high morale and they tend to make things happen.

From the above-mentioned explanation, it is known that the ability to think logically on the one hand is important to be considered by the students. On the other hand, many students still do not have this ability. This fact encourages the researcher to uncover the analysis of logical thinking ability of students from its cognitive style.

2. Literature Review

2.1 Logical thinking ability
Logical thinking ability has an important role in student learning outcomes and the process of construction of a concept [9]. Logical thinking can be interpreted as an activity of thinking to gain knowledge according to a particular pattern or logic [9][10]. Logical thinking is also raised by some other experts [9]. Logical thinking or serial thinking is defined as: process to reach a conclusion using reasoning consistently [9], and thought that includes induction, deduction, analysis and synthesis. It can be concluded that the ability to think logically is the ability to obtain a conclusion based on reasoning in induction, deduction, analysis or synthesis that are done consistently.

The ability to think logically includes the ability to: 1) draw or make conclusions, estimation and interpretation based on appropriate proportions, 2) draw conclusions or make forecasts and predictions based on chance, 3) draw conclusion or make estimation or prediction based on the correlation between the two variable, 4) determine the combination of several variables, 5) analogy is draw conclusions based on similarity of the two processes, 6) do the proof, 7) compose the analysis and synthesis of some cases [9].
The ability to think logically is required by the individual, during the activity of making decisions, drawing conclusions, and solving problems. The form activities performed can be related to mathematical problems and problems which are found in everyday life. Other activities undertaken by individuals in logical thinking is when explaining why and how a result is obtained, how to draw conclusions from available premises, and draw conclusion based on certain inference rules. The form of the activity that is broader than the logical thinking ability is to solve problems reasonably [9][10]. Rahman & Ahmar [9], perform a measurement of logical thinking ability based on the theories of Piaget's mental development using Test of Logical Thinking (TOLT) instrument, which consists of five components: controlling variables (Controlling variable), proportional reasoning (proportional reasoning), probabilistic reasoning (probabilistic reasoning), correlation reasoning (correlation reasoning), and combinatorial reasoning (Combinatorial thinking).

2.2 Adversity quotient
Stoltz [8] propose a new intelligence than IQ, EQ and SQ i.e. Adversity Quotient (AQ). AQ has three forms [11], namely (1) AQ as a new conceptual framework for understanding and improving all kinds of success, (2) AQ as a measure to know response towards Adversities, and (3) AQ as a series of basic tools which has a scientific basis for improving the response to adversity. In order for making success to be real so, Stoltz [11] stated that a combination of the three elements above namely new knowledge, benchmarks, and practical equipment are a complete unity for understanding and improving the basic components of reaching success.

Stoltz [8] has shown that organizations that have a higher AQ Collective will enjoy a range of benefits including greater performance, creativity, resilience and vitality than a low AQ. In conducting this process, Stoltz also has given the leaders of certain organization that is a new way to limit, demonstrate and develop a high performance for a worker. And he has given him a sustainable path, a map and compass to foster a culture of perseverance and achievement, and with the new ideas that will result in a change in management.

Furthermore, Stoltz [8] mentioned that a person, who has a higher AQ, will not easily blame other parties due to the problem that he faces but responsible to solve the problem. Conversely, the low AQ of a person is the dullness of survival, complaining throughout the day when facing the problem and they are hard to see the wisdom behind all problems that they are faced.

Stoltz [8] classifies people into three categories, namely: quitter (low AQ), camper (medium AQ), and climber (high AQ). A person who is included the quitter is categorized to have 59 AQ or lower, camper has 95-134, and climber category has 166-200. A quitter by category tend to avoid tasks given by the teacher, the spirit of learning is low, avoid the challenge and do not contribute much in study groups. Quitter students tried to stay away from the challenge which is given, choose to retreat if they are given a difficult task by the teacher. Camper Students have a little bit of initiative, little spirit, and their effort is less than the maximum. Camper student is a child who does not willing to take risks that are too big and feel satisfied with conditions or circumstances that have been achieved at this time. He/she also ignores the possibilities that will be obtained. Child in this category will be quickly satisfied or always feel enough when he/she stays in the middle position. They do not maximize their efforts even though the opportunity and the chance are available. No attempt to be more active in learning. In mathematics learning, the camper does not try as much as possible. They try to be simple. Climber students welcome the challenge, can motivate themselves, have high spirits, they tend to make everything happens, constantly looking for new ways to grow and contribute, work with vision, full of inspiration, always find ways to make things happen [12].

Description and Characteristics [13]:

Quitter
1) Refused to climb higher
2) His/her lifestyle is unpleasant or flat and not “complete”
3) Working just enough to live
4) Tend to avoid the overwhelming challenge that arises from true commitment
5) It is rare to have true friendships
6) When facing a change they tend to fight or run and tend to resist and sabotage change
7) Skilled in using words that limits her/himself, such as “do not want”, “impossible”, “this is ridiculous” and so on.
8) His ability is small or even does not exist; they have no vision and belief in the future, the contribution is very small.

Camper
1) They want to climb, although they will “stop” at a certain post, and feel adequate up there.
2) They are quite satisfied to have reached a certain stage (satisfier).
3) Still have a number of initiatives, a little spirit, and some efforts.
4) Sacrificing individual ability to get satisfaction, and able to build relationships with other campers.
5) Refrain from change, although sometimes do not like big changes because they feel comfortable with the existing conditions.
6) They use compromising language and words, for example, “this is good enough,” or “we just enough to reach this state”.
7) Their achievements are not high, and their contributions are not either
8) Although they have gone through various obstacles, but they will stop as well at some point and they “settle” there.

Climber
1) They devote themselves to continue to “climb”, they are thinkers who always think of possibilities
2) His/her life is “complete” because they have passed and experienced all the previous stages. They realize that there will be many rewards earned in the long run through the “small steps” that are being passed
3) Welcomes challenges, self-motivation, high spirits, and strives for the best in life; they tend to make things happen
4) Not afraid to explore the limitless potentials that exist between two humans; understand and welcome the painful risks posed by accepting criticism
5) Welcomes every change, even encourages any of those changes in a positive direction
6) The language used is language and words filled with possibilities; they talk about what can be done and how to do it; they talk about action, and are impatient with words that are not supported by deeds
7) Give a big enough contribution because it can realize the potential that is in him/her
8) They are familiar with difficult situations because difficulty is part of life

2.3 Cognitive style
Cognitive style refers to the way people obtain information and use strategies to respond to a task. It is called as a style and not as a capability as it refers to how people processes information and solves problems, rather than refer to how is the best.
Some experts like Messik, Zelniker & Waber [14] provide a definition of a similar cognitive style, i.e. cognitive style is a relatively fixed tendency of a person to receive, think, and solve problems, as well as remember information. Furthermore Soedjadi (in cite [15]) suggests that: Cognitive style can be distinguished by the form of intelligence and other dimensions of ability.
There are two cognitive styles that are specifically important in education as follows: “field-independent versus field-dependent and impulsive versus reflexive.” Each of these cognitive styles is based on differences in psychology and conceptual tempo”.
Witkin (in cite [16]) said that: people who have a field-independent cognitive style responds to a task tend to lean or based on the terms of the self. Meanwhile, people who have field-dependent cognitive style sees environmental requirements as a guide in response to a stimulus, moreover Witkin
(in cite [17]) stated that: people who have field-independent cognitive style is more analytical, they can choose a stimulus based on the situation/information, so that small part of their perception is only affected when there is a change in the situation/information. Meanwhile, people who have field-dependent cognitive styles have difficulty in distinguishing stimulus through situation/information that is owned so that perception is influenced by manipulation of the situation/information around them [18].

In detail, Good & Brophy [17] make implication distinction for both cognitive styles of students in mathematics learning in the classroom, as depicted in the following table:

**Table 1. Learning Process Based on Student Cognitive Styles**

| Students’ Learning Process                                                                 | Field-Dependent                                      | Field-Independent                                      |
|-------------------------------------------------------------------------------------------|------------------------------------------------------|--------------------------------------------------------|
| • Globally acceptance                                                                      | • Analytical acceptance                              |
| • Globally understand the given structure.                                                | • Articulately understand the given structure or restriction |
| • Make a general and broad distinction between concepts, seeing relationships/connections. | • Make specific conceptual differences with little possibility of overlapping. |
| • Social orientation                                                                       | • Orientation not on individual                      |
| • Learning material that is more social.                                                   | • Learning social material just to be a purposeful task. |
| • A good material is the material that is relevant to their experience.                    | • very interested in new concepts for his/her own interests |
| • Requires outside help and endurance to achieve the goal.                                | • Goals can be achieved by reinforcing themselves.    |
| • Requires organizing.                                                                     | • Can be done with its own structure situation        |
| • More affected by criticism.                                                              | • Slightly affected by criticism.                     |
| • Use the approach of observation to reach the concept.                                   | • Use the hypothesis test approach in achieving the concepts. |

3. Research Method
This type of research is qualitative research. The focus of this research is to determine the logical thinking ability and adversity quotient of Statistics Student batch III FMIPA UNM and reviewed from cognitive style. The population in this study is all Statistics Department students batch III in Universitas Negeri Makassar. The determination of the subject in this study is conducted by referring to the results of cognitive style tests. Based on the cognitive style test results, students are grouped into two, namely: group of students that have field-independent cognitive style (FI) and group of students who have field-dependent cognitive style (FD). The sample in this study is as many as 19 students. The data collection in this research uses the main instrument, i.e. the researchers themselves, in addition the main instrument, it is also used supporting instruments, namely: (1) The Instrument of Logical Thinking Ability (TOLT), and (2) The Instrument of Adversity Quotient (AQ).

4. Result and Discussion
4.1. Description of cognitive style
The cognitive style data of students in this study is obtained from the results of cognitive-style tests on 19 students batch III Statistics Department at FMIPA UNM. Based on the cognitive-style test results, it is obtained the data as in the following table.
Table 2. Description of Student Cognitive Style

| Respondent | Cognitive Style | Sum |
|------------|----------------|-----|
|            | FI  | FD  |   |
| Batch III  | 17  | 2   | 19|
| Percentage | 89.5| 10.5| 100|

Note: FI=field-independent; FD=field-dependent

Based on table 2, it is obtained that of the 19 students who took the tests of cognitive style, there were 17 (89.5%) students who were in the group of field-independent cognitive style (GK-FI), and 2 (10.5%) of students who are at groups of field-dependent cognitive style (GK-FD).

4.2. The description of logical thinking ability

The Data of Logical Thinking Ability Students in this study is obtained from the results of TOLT tests on 19 students batch III Statistics Department at FMIPA UNM. Based on TOLT test results, it is obtained such data in the following table.

Table 3. The Description of Logical Thinking Ability

| Respondent | Logical Thinking Ability | Sum |
|------------|--------------------------|-----|
|            | concrete | transitional | formal |   |
| Batch III  | 4        | 2            | 13      | 19 |
| Percentage | 21       | 10.5         | 68.5    | 100|

Based on table 3, it shows that of the 19 students who took the TOLT test, there are 4 (21%) of students who have logical ability of concrete operations, and 2 (10.5%) of students has a logical ability of transitional operation, and the remaining 13 (68.5%) students have the ability of formal logical operations. The ability to think logically divided into five components: Proportional Reasoning, Controlling Variables, Probabilistic reasoning, correlation reasoning, and Combinatorial Reasoning. The results of students' logical thinking ability based on 5 components are as follows.

4.3. The description of adversity quotient

The data of Adversity Quotient Students in this study is obtained from the Adversity Quotient (AQ) test results on 19 students of Statistics Department batch III FMIPA UNM. Based on AQ test results, it is obtained such data in the following table.

Table 4. Description of Adversity Quotient

| Respondent | Adversity Quotient | Sum |
|------------|--------------------|-----|
|            | Low    | Medium | High |   |
| Batch III  | 1      | 18     | 0    | 19 |
| Percentage | 5,3    | 94,7   | 0    | 100|

Based on table 4, it shows that of the 19 students who took the AQ tests, there is 1 (5.3%) student who has a low AQ, and 18 (94.7%) of students have medium AQ ability.

4.4. Discussion

To see the connection between logical thinking ability and cognitive style as well as adversity quotient and cognitive style, so that it is presented in the following table.
Table 5. Cross Tabulation of Logical Thinking Ability and Cognitive Style

| Logical Thinking Ability | Cognitive Style |
|-------------------------|-----------------|
|                         | FI  | FD  |
| Concrete                | 3   | 1   |
| transitional            | 1   | 1   |
| Formal                  | 13  | 0   |

Based on table 6, it is found that students' logical thinking ability is dominated by formal field independent cognitive-style. This is because students who have the FI cognitive styles FI uses hypothesis test approach in achieving concept and interpret it analytically. Unlike the FD cognitive style, it uses observation approach to achieve the concept. Students with formal operational logical thinking ability can connect certain information, idea, and problem solving that happened to him/her. In other words, students with formal operational logical thinking ability are able to work on and/or solve problems by making quick efforts in various ways in solving problems. The ability to think logically in formal operations is in line with the FD cognitive style that is the interest with a new concept for the benefit of him/her and uses hypothesis testing approach in achieving the concept by considering various possibilities into solving the problem.

Table 6. Cross Tabulation of AQ Capability and Cognitive Style

| Adversity Quotient | Cognitive Style |
|--------------------|-----------------|
|                    | FI  | FD  |
| Quitter            | 1   | 0   |
| Camper             | 16  | 2   |
| Climber            | 0   | 0   |

In table 7 shows that the adversity quotient (AQ) of camper category is dominant compared to other categories (quitter and climber) and none of the students who have the climber ability. From this camper category there are 16 students (84.2%) who have field independent cognitive style and the remaining 2 students (10.53%) have cognitive style of dependent field. Students who are categorized as camper have a little encouragement, a little initiative, and sometimes less than the maximum effort. Camper students’ category is students who are satisfied with a state that has been reached today and do not want to take risk too much. They also ignore the possibilities that they will be obtained. Students of this category easily satisfied and always feel enough is in the middle position. They often do not maximize their effort despite the fact they have the chance and opportunity. In terms of learning, student in this camper category has no effort to study harder, not as hard as possible and sometimes they just try as they can. This is in line with the cognitive style of field dependent, where the FI cognitive style is in the process of learning needs external assistance and reinforcement to achieve the goals as well as arouses common differences and broader between the concept, the relationship/linkages and understand the global structure which are given.

5. Conclusion
Based on the result analysis of research data, some conclusions from these research results that is logical thinking ability of students is dominated by logical thinking ability of formal operation as many as 68.5% and is dominated by cognitive style of field independent. Based on the SOLO taxonomy, the subject of GK-FD and GK-FI have obstacles in solving the problem of problem-solving that is: (1) the subject does not have enough readiness and lack of planning to solve problem of problem-solving, (2) the subject does the trial process in applying the formula or process but the
formula or process is not appropriate to solve the problem. For Adversity Quotient (AQ), camper
category is dominant compared to other categories (quitter and climber) and none of the students who
have the climber ability. From this camper category there are 16 students (84.2%) who have field
independent cognitive style and the remaining 2 students (10.53%) have cognitive style of dependent
field. Students who are in camper category have a little encouragement, a little initiative, and
sometimes less than maximum effort. Students in camper category are students who are satisfied with
a state that has been reached today and do not want to take too much risk.

References
[1] Munir R, 2005 Matematika Diskrit.
[2] Arsyad N Rahman A and Ahmar A S, 2017 Developing a self-learning model based on open-ended
questions to increase the students’ creativity in calculus Glob. J. Eng. Educ. 19, 2 p. 143–147.
[3] Marbun R H and Syafimien W, 2014 Analisis Kemampuan Berpikir Logis Siswa Gayal Belajar
Tipe Thinking dalam Memecahkan Masalah Matematika J. Ilm. Dikdaya 4, 2.
[4] Setyawan D and Rahman A, 2014 Eksplorasi Proses Konstruksi Pengetahuan Matematika
Berdasarkan Gaya Berpikir Sainsmat 2, 2 p. 140–152.
[5] Sumarmo U Hidayat W Zukarnaen R Hamidah M and Sariningsih R, 2012 Kemampuan dan
Disposisi Berpikir Logis, Kritis, dan Kreatif Matematik (Eksperimen terhadap Siswa SMA
Menggunakan Pemelajaran Berbasis Masalah dan Strategi Think-Talk-Write) J. Pengajaran
MIPA 17, 1 p. 17–33.
[6] Suestyani S Rinanto Y and Widoretno S, 2015 Improve the Students’ Logical Thinking
Through Discovery Learning Application about Reproduction System Material in XI MIA 1 of
SMA Batik 2 Surakarta Academic Year 2014/2015 Pendidik. Biol. 7, 3.
[7] Fitriana S Ihsan H and Annas S, 2015 Pengaruh efikasi diri, aktivitas, kemandirian belajar dan
kemampuan berpikir logis terhadap hasil belajar matematika pada siswa kelas VII SMP J.
Educ. Sci. Technol. 1, 2 p. 86–101.
[8] Stoltz P G, 1997 Adversity quotient: Turning obstacles into opportunities John Wiley & Sons.
[9] Rahman A and Ahmar A S, 2016 Exploration of mathematics problem solving process based
on the thinking level of students in junior high school Int. J. Environ. Sci. Educ. 11, 14.
[10] Mulbar U Rahman A and Ahmar A S, 2017 Analysis of the ability in mathematical problem-
solving based on SOLO taxonomy and cognitive style World Trans. Eng. Technol. Educ. 15, 1
p. 68–73.
[11] Stoltz P G, 2000 Adversity quotient @ work: Make everyday challenges the key to your
success William Morrow.
[12] Suhartono, 2012, Proses Berpikir Kreatif Siswa SMP dalam Memecahkan Masalah Matematika
Berdasarkan Adversity Quotient (AQ), Thesis. Pascasarjana Universitas Negeri Surabaya.
[13] Sriot A, 2008, Adversity Quotient (AQ). Jatinangor. Fakultas Ilmu Keperawatan Universitas
Padjadjaran.
[14] Rahman A, 2003, Analisis hasil belajar matematika berdasarkan gaya kognitif guru dan gaya
kognitif siswa pada Kelas II SMU Negeri 3 Makassar, Makassar, Indonesia.
[15] Rahman A, 2010, Profil Pengajuan Masalah Matematika Berdasarkan Gaya Kognitif Siswa.
Disertasi tidak diterbitkan. Surabaya: PP’s UNESA Surabaya.
[16] Elkind D and Weiner I B, 1978 Development of the child USA: John Wiley & Sons.
[17] Good T L and Brophy J E, 1990 Educational psychology: A realistic approach, 4th ed.
Longman/Addison Wesley Longman.
[18] Ahmar A S Rahman A Minggi I Mulbar U Upu H and Tiro M A, 2018 The Profile of
Creativity and Proposing Statistical Problem Quality Level Reviewed From Cognitive Style J.
Phys. Conf. Ser. 954.