AN AUTO-ETHNOGRAPHIC STUDY: EXPLORING MATHEMATICAL CONCEPTS ON PROBLEMS RELATED TO ENVIRONMENTAL CARE

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Abstrak

Akhir-akhir ini banyaknya bencana terjadi akibat dari kurangnya sikap peduli pada lingkungan misalnya saja banjir, dan tanah longsor. Ketidakpedulian ini yang menjadi awal dari timbulnya bencana besar yang berasal dari kebiasaan kurang baik dari orang yang tidak bertanggungjawab. Membuang sampah sembarangan, merusak lingkungan dengan tidak mempedulikan tanaman salah satu misalnya akan sangat berdampak buruk bagi kehidupan kita selanjutnya. Oleh karena itu, pada penelitian ini peneliti ingin mengintegrasikan masalah tersebut. Penelitian ini, menggunakan jenis penelitian *transformative research* yang menggunakan teknik analisis data dari penelitian kualitatif. Hasil penelitian *transformative research* adalah studi *auto/ethnography*. Dari hasil a*uto/ethnography* ini, peneliti bertujuan untuk menggali konsep Matematika dari masalah tersebut dalam analisis pengembangan Kompetensi Dasar pada jenjang Sekolah Dasar sehingga ke depannya bisa diajarkan dan dibuat rancangan pembelajarannya serta dapat pula diajarkan di sekolah selain pada itu siswa juga bisa belajar untuk mempedulikan lingkungan sekitarnya.

Kata Kunci: Penelitian kualitatif, *transformative research*, *auto/ethnography*, lingkungan, sekolah dasar.

1. INTRODUCTION

Disasters caused by problems from lack of concern for the environment have become serious problems these days. The impact has been very detrimental, not infrequently there are also those who lose their lives because the disaster of loss of property is common. However, this problem cannot be left alone, the lack of responsibility as an individual who can damage the environment must be stopped immediately, including in the school environment. In addition to home, school is also a place to learn to care about the environment. The attitude of each individual at school reflects the individual when in his home. If in the house is taught to care about the surrounding environment, in school it will be the same he will also be able to care about his environment. And vice versa, if at home he is used to not caring about the surrounding environment. Then in school will do the same. Initially, this problem was taken from the experience of researchers who several times saw students in their place of teaching who did not care about their school environment. Every time they were asked, they always argued with a rebuttal that at home their parents never reprimanded him every time he threw the garbage out of place and some even admitted that they followed the habit of their parents who often damaged crops. This will, if done continuously, will certainly further muddy and foster disasters in the future.

Schools are also one of the places responsible for being able to teach their students to care about their environment. From this problem, researchers want to be able to integrate the problem in every lesson, including mathematics subjects. However, there are still those who do not believe that starting from the study of auto / ethnography, it cannot be integrated with mathematics subjects because they consider that mathematics is a systematic and modernized subject so that the problem cannot be related to mathematics. Whereas their assumption is contrary to some modern mathematicians such as (Ernest et al., 1991) & (Bourne, 1978) who consider that Mathematics as a social constructivism with the emphasis that students are seen as active beings in constructing science through interaction by digging or solving problems that are closely related to its environment. In addition, Mathematics is a human activity according to opinion (Fruedenthal, 1971) & (Gravemeijer, 2000). The human activity in question is an activity to be able to understand, explore, and solve problems related to the context in everyday life.

In addition, the research school is a school that dreams of becoming an adiwiyata school or referred to as an environment-based school, before achieving that goal, students must be accustomed to caring about their environment, of course, cultivating an attitude of environmental care for children, it takes a long time so that children feel accustomed to Providing experiences to care about the environment and inserting it into learning is a challenge for adiwiyata schools. So to achieve this goal, schools must be able to integrate in every learning, including mathematics subjects. This environmental concern

problem also deserves to be packaged in Mathematics learning which is interesting for students to learn about Mathematical concepts that will arise later and at the same time as learning to increase concern for the surrounding environment. So that students better preserve and take care of the plants that are around them. In addition, there are also other benefits as according to (Ghent, et al., 2014) in his article which explains that there is a correlation between improving student learning outcomes and schools that are environmentally based and all are concerned about the environment. The findings also support and justify the statement (Ernst & Monroe, 2004) that suggests an effective approach to an environment-based school program will be able to significantly improve student learning outcomes. Then the value is that the school environment will be healthy and will get a lot of oxygen supply from the vegetation in the school garden. There is nothing wrong if this topic is used as a context in learning.

Based on the above background, the researcher wants to create an auto/ethnography study related to the problem. This auto / ethnography will later be analyzed specifically for mathematics subjects so that they can be adjusted to the basic concepts of mathematics learning so that they can be taught in the classroom.

2. RESEARCH METHODS

The research used by researchers is a type of qualitative research, namely transformative research. This research procedure was proposed by Taylor (2015), based on five ways of knowing (five dimensions of knowledge) in transformative research which is the spirit of transformative research. The five ways of knowing consist of: (1) Cultural-self-knowing, (2) Critical knowing, (3) Relational knowing, (4) Visionary and ethical knowing, and (5) Knowing in action. The five dimensions of knowledge do not have to be carried out sequentially so that they can be adjusted to the beginning of the problems raised in each study. If in this auto / ethnography study begins with Cultural-self-knowing obtained from the results of observations and interviews in the environment around researchers related to environmental care problems. Then continued with Critical knowing which writes the results of the researcher's criticism related to whatever is heard, seen or even natural researchers related to culture related to the problem to be written by the researcher. Furthermore, Relational knowing which is the process of looking for relationships from auto / ethnography results in the form of stories, poems or drama scenarios written using the creative writing method. The next Knowing is Visionary and ethical knowing in it there is a vision of the researcher as a teacher to be able to integrate in mathematics subjects and it is hoped that students have a caring attitude towards their environment then the last one is Knowing in action which relates the concept to the basic competencies of elementary school mathematics subjects so that later learning tools can be made that are in accordance with the integration of this environmental care problem.

The data collection technique used by the researcher is a data collection technique that is in accordance with the auto / ethnography study, namely, narrative as inquiry, document analysis, documentation, interviews and observations. Meanwhile, the data analysis technique used in the auto / ethnography study of data analysis techniques according to Miles & Huberman (1984) which states that qualitative data analysis techniques are carried out continuously until the data is saturated.

The data analysis technique used is data reduction, data reduction that researchers do in transformative research related to the auto / ethnography method is to reduce the researcher's experience which is only related to environmental care problems, then by reducing information from the internet which is only related to environmental care related to document analysis data collection techniques. Then data display (Presentation of data) by displaying data, then the data will be easier to read the pattern, the category. The presentation of data is then presented in the form of charts, graphs, flowcharts, intercategory relationships and so on, then it can be presented in the form of a description so that it is easy to understand the meaning. Furthermore, the last one is Conclusion drawing / verification (Conclusion), the last step of the data analysis stage is drawing conclusions and verification. Initial conclusions are temporary, and may change when no evidence is found at the data collection stage.

The data validity techniques in transformative research are as follows according to Taylor (2007b) First, trustworthiness and Authenticity, in which there is creadibility (trust), dependability (dependency check), transferability (relationship check) and confirmability (certainty) (in Mariana, 2017: 119). Second, Dependability, if the research is carried out open-ended, for example during research and when the researcher feels that there is a lack of data, the researcher will add data sources or research methods. Third, Confirmability, is said to meet the confirmability criteria if the data written by the researcher is based on a clear source, and the source can provide confirmation of the data that the researcher made. Fourth, Verisimilitude is one of the technonics of the validity of data in the transformative research type used as a literary standard so that writing is interesting, coherent and looks right (Mariana, 2017: 121). Fifth, Praxis is a data validity technique based on critical actions through mathematical concepts found in environmental concern problems.

Briefly, if this research starts from reducing experiences, observation results, interviews or even conducting document analysis activities, the problem

will then be written down using the creative writing method so that the results of auto / ethnography will later be in the form of stories, poems or scenario dramas. Then, it will be analyzed the mathematical concepts that explicitly exist in each story, poem or scenario of the play until it is found in the basic competence of mathematics subjects in elementary school.

3. RESULTS AND DISCUSSIONS

The result of the transformative research is four stories and one drama scenarios, all of which are the researcher's auto/ethnography on environmental issues. The following is a summary of the story and scenario of the drama from the experience of the researcher and the mathematical concepts that appear in it:

1. Story 1: "I Learned from the Environment"

This story contains the experiences of researchers during elementary school which tells about the first experience of researchers who were then given the task of invading dicotyledonous and monocotyledonous plants which then together with his group of researchers made the observation in a rice field near the researcher's house. Immediately, researchers realized that mathematics is part of everyday life. In story 1, there is a mathematical concept that shows the time, which shows 12.30 WIB. In story 1, there is also a mathematical concept of fractional concepts in paragraph 6 showing the measurement of the height of 5 of the 30 corn plants in the yard. This indicates the presence of a part of the overall number.

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2. Story 2: "Don't Break My Garden!"

In story 2, it tells the story of devotional work activities that are routinely carried out every Friday. Every time they go home from school the children always clean the garden but there are groups from wealthy families, damaging the plants. When all the people cleaned up the environment, the group of children actually made a fuss by damaging the plants, deliberately cutting off the ornamental plants in the front garden of class II-B. There are 10 houseplants 1 plant is tamped with each stem cut. In story 2 there is a Mathematical concept of fractional concept in paragraph 4 showing 1 of the 10 ornamental plants to be planted in the front garden of class II-B. Furthermore, story 2 also has a mathematical concept, namely the concept of geometry in paragraph 4 shows the area of the classroom garden measuring 3.5 m × 1 m. This can be used as a learning of measuring the area of a building with the concept of geometry. Then, story 2 also has a mathematical concept, namely the concept of processing and presenting data in paragraph 7 shows the average results of measuring the height of ornamental plants. Then it can be used as a learning for data processing and presentation.

3. Story 3: "I'm beginning to realize"

This story tells if there are people who do not understand that growing plants requires a long process, not just planting without caring. Plant development and growth is not an instantaneous process. But, it took quite a long time. In story 3 there is a mathematical concept, namely the distance in paragraph 2 which shows the distance between the house and the river reaches 3 m. Then it can be used as a lesson about measuring units of Length. Then there is the concept of mathematics, namely the concept of geometry and measurement in paragraph 4 which states that if you plant at the same time you must also pay attention to the planting distance, for example in rice fields measuring 10 m × 100 m so that plants can still grow well and not crowded. This can be used as a measurement lesson.

4. Drama Scenario 1: If You Understand, Understand Our Message

This scenario has several scenes that tell the story of environmental damage in the forest. It tells the story of a conversation or what is felt by plants that have forests that are cut down indiscriminately. The plants talked to each other about what they were feeling. In scenario drama 1, there is also a mathematical concept, namely the concept of geometry in scene 3 shows the diameter of the tree ranging from 4-5 m and the area of land to be cut down reaches 250 ha, or a length of 10,000 m and a width of 2500 m. This can be used as a learning of measuring the area of a building with the concept of geometry. Then there is also the concept of mathematics, namely the concept of processing and presenting data in scene 3 which shows the average results of measuring the height of trees in the forest which reaches 50 m. Then it can be used as a learning for data processing and presentation.

5. Narrative Story 4: My School's Dream to become an Adiwiyata School

This story tells about the expectations of the research school that hopes to be an adiwiyata school. The designation is pinned on schools that have afforestation programs and have a large enough land to do greening. Unlike the schools where researchers teach, which do not have enough land to do greening, let alone greening for the routine flag ceremonies every Monday is not enough. This is a challenge for

the school where researchers teach to be an adiwiyata school.

In story 4, there is a mathematical concept, namely the concept of geometry in paragraph 2 which states the area of the school land 1932 m2 and paragraph 4 regarding the school hallway garden with a length of 7 m × 1.5 m. From this concept, it can be used as a learning of measuring the area of a building with the concept of geometry. Then, the concept of mathematics, namely the concept of processing and presenting data in paragraph 5 which shows the average result of measuring plant height after three months of planting is about 30 cm, then, it can be used as a learning for processing and presenting data. Furthermore, the fractional concept in paragraph 4 shows 1 of the 4 students who packed the plants. This indicates the presence of a part of the overall number.

Mathematical Concepts That Often Arise in Problems Regarding Concern for the Environment

There are several mathematical concepts that often appear in auto / ethnography, namely:

1. The Concept of Geomerti and Measurement

This Mathematical concept appears in all the stories and drama scenarios of the auto/ethnography study. Mostly regarding area measurement, plant height measurement.

2. Concept of Data Processing and Presentation

This mathematical concept also appears in all drama stories and scenarios, most of which are the results of calculating the average plant height.

3. Fractional Concept

This Mathematical concept appears in story 1 and story 4 which explain part of the whole. For example, in story 1, plant 1 of the 10 plants to be planted.

Furthermore, mathematical concepts that accidentally appear in the storyline and scenario scenes of the play will be used to compile learning activity according to mathematical concepts that appear more often in this Auto / ethnography study. Perhaps many have not realized if it turns out that Mathematics is one of the sciences that can solve problems in everyday life. According to Haryono (2014: 122) that with the rapid development of science, Mathematics participates in contributing to other fields of disciplines to help solve existing problems.

As in the explanation of the definition of Mathematics previously discussed, it is only natural that some experts such as Reys, et al (1998) that Mathematics as a human activity or Mathematics is a human activity. The influence of a person's habit of looking at Mathematics is stated by Hersh (1981) who views Mathematics as not only a physical or mental activity, but Mathematics is a social activity. Mathematics is part of human civilization therefore Mathematics continues to develop along with human needs. Mathematics can be a solving tool of all human problems, Mathematics is part of human life. It's just that most Humans have not realized that the concept of Mathematics has been ingrained in the human mind. Such concepts range from simple calculations to the most complex.

In accordance with this sub-chapter, this Mathematics cares for the environment is the use of Mathematical science to solve problems and foster an attitude of caring for the environment. The integration between Mathematics and the problem of caring for the environment is called Eco-Mathematics. In relation, Mathematics takes a role to reconcile global conflicts, reflect critically on beliefs, and always engage empathetically in decision making (Taylor, 2019)

STEAM (Science, Technology, Engineering, Art, and Mathematics) based education is a form of designing learning activities with the aim of making students knowledgeable and moral human beings so that they can always be involved and play an active role in solving problems and contributing to decision making for sustainable impact. The basic principles of sustainability include: (1) Using various pedagogic techniques that are the basis of participatory learning and higher-order thinking ability, (2) learning must be lifelong and sustainable, (3) relevant, (4) based on needs, conditions and perceptions that adjust to regional needs but are still useful for a large scale, (5) community-based decision making, social tolerance and environmental insight, and (6) are cross-disciplinary (Taylor, 2019).

This partnership supports context-based learning and supports STEAM education. So it is hoped that through mathematics learning by integrating these environmental problems as well as being able to foster an attitude of caring for the environment in students. In addition, according to the results of research conducted by Gent, Cynthia, et al (2014) There are many benefits that will be obtained if students have an attitude of caring for the environment, including a correlation between the improvement of student learning outcomes, a significant increase in student learning outcomes in maples (Mathematics, arts and languages) and an increase in student concern for the environment.

Thus, there is nothing wrong with integrating the problem of environmental concern with mathematics. In addition to changing the paradigm of most students who think that Mathematics is a difficult subject (Fathani, 2014) by utilizing such integration students will also be more concerned about their environment.

Then, regarding the cultivation of environmental care attitudes to be achieved also from this research. Because researchers think this is very important for students. Students' good response to the environment is also one of the indicators of an attitude of caring for the environment. As Azwar (1995: 15) argues that an evaluative response is a form of reaction expressed as an attitude based on an

evaluation process in the individual, which can differ from one individual to another can be a justification in the form of good-bad, positive-negative, unpleasant-unpleasant values that then relate as a reaction to the object of attitude. The statement is supported by Fishbein & Ajzen (1977) if attitude is a learned predisposition to respond positively-negatively, agree-disagree, to an object, concept, situation or person. Attitudes can consist of emotional (affective), thought (cognitive) and tendency to action (conative). Fishbein & Ajzen's statement is supported by Secord & Backman (1964) that attitude is order in terms of feelings (affection), thinking (cognition) and predipositions of actions (conation) to aspects of the surrounding environment.

Both have the same definition of affective, cognitive and conative. If the affective aspect is the feeling that a person has towards an object. The cognitive aspect is a person's belief or belief in something. As well as the conative aspects that are the tendency of a person to behave in a certain way towards an object.

Thus, it can be concluded that if the attitude is a response to a certain object that arises after a given stimulus, the reaction can vary from individual to individual. But, the reaction or response always contains affective aspects, cognitive aspects and conative aspects, all three of which are based on the self-evaluation that has been carried out.

After explaining about the attitude, the next step is to discuss the meaning of caring. According to the KBBI, caring means paying attention, ignoring, and paying attention. Meanwhile, caring is a behavior that cares about something. It can be concluded that environmental concerns are sensitive, pay more attention to matters related to the environment and always maintain beauty, prevent damage or pollution to maintain environmental stability.

Meanwhile, according to Supardi (2003: 4) if caring for the environment means participating in preserving the environment to maintain the stability of the survival of humans and the universe. Meanwhile, to maintain the stability of the environment has the following indicators, a) Avoid and save the earth's source from pollution and damage. b) Make the best use of non-replaceable natural resources. c) Avoid actions that can cause instability of the earth such as pollution and damage to the environment. d) Maintain and improve the environment for future generations.

Some of the indicators stated by Supardi are supported by Sue (2003: 43) if environmental concern means daring to express an attitude towards environmental quality which is manifested in one's willingness to always maintain and improve the environment and as much as possible to avoid and save the earth from forms of pollution and damage. Meanwhile, according to Suparno (2004: 84) suggests that the attitude of caring for the environment is a form of appreciation for nature, what is meant by appreciation is a reason that humans are part of the old, so it can be concluded that loving nature is the same as loving fellow humans.

Furthermore, Nenggala (2007: 173) argues that there are eight indicators that a person can be said to have an attitude of caring for the environment, including: a) Always throwing garbage in its place, b) Not deliberately picking up, cutting down or uprooting plants in his environment; c) Always maintain the sustainability of the surrounding environment; d) Not burning garbage around housing; e) Not doodling, writing on trees, road stones or walls; f) Hoarding used goods; g) Carry out routine activities to clean the environment; and h) Cleaning up the garbage that clogs the waterways.

Unlike Supardi, Sue and Nenggala's attitude of caring for the environment is a real action of attitudes carried out by a person to be said to have an attitude of caring for the environment. If nenurut Dewi (2009: 116) the attitude of caring for the environment is an attitude that can be expressed in the form of verbal, thoughts, ideas, views on environmental problems that can be influenced by the educational background and the environment of the community and is a contribution to overcome environmental reconciliation that must be done comprehensively, globally and sustainably.

Therefore, it is important for students to have an attitude of caring for the environment as stated by (Hammarsten, et al. 2018) from the results of their research for many years, if in everyday life an attitude of environmental care has been instilled, it will have a very big impact on the sustainability of life of the next generation. Because children will feel part of nature so that the caring attitude that is instilled in children from an early age makes children will always take care of their environment.

Then, to be able to assess the attitude of Kusaeri & Suprananto (2012: 193) explaining attitudes can be assessed using several ways including direct observation of the observed response, interview with someone about a certain attitude and someone's personal report on the views of a problem regarding something.

4. CONCLUSION

After conducting transformative research in accordance with the main paradigm used, namely cultural self-knowing of the problem of lack of student care attitudes in the place where researchers teach. This research produced four narrative stories and one drama scenario, all of which contained several mathematical concepts, including the concept of measurement, the concept of geometry, and the concept of data processing and presentation. However, according to the discussion in chapter V, the concept of Mathematics that often appears will be used for further research, namely design research and

the concept that often appears is the concept of processing and presenting data.

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