The Exploration of Mathematical Knowledge of the Society in the Design and Implementation of Thematic Assignment in Sangihe Regency

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Abstract
This article explains about the result of a research about the exploration of mathematical knowledge of the people in Sangihe regency, to be developed as thematic-material assignment which being implemented with the participation of the society. This research is also a part of the development of democratic-learning research by thematic assignment in Sangihe regency. The research activity consists of the following stage: (1) identification – the formulation of mathematical element from nature phenomenon and society; (2)formulation of mathematical-concept networking and its connection with science concept; (3) formulation of students group's activity form (assignment) with parents and society's participation; (4) formulation of evaluation instruments which comprises of cognitive, psychomotor, and affective fields, (5) implementation of thematic-assignment design (being held out of study hours) with the participation of students' parent. The approach that is being used in material designing and learning activity is participatory approach, which involves students and parent/society's participation. In the implementation stage, the parents and society's role is as interviewees (according to their experience and skill) or as student's study partner, especially in problem discussion and overcoming-problem experience which being the learning topic. This article explains about the example of identification result – design and implementation of landslide's thematic assignment. Overall, this research becomes model for the development of mathematical learning based on children's environment, which later will enable them to integrate the knowledge they acquire at school with the daily experience and necessity.

Keywords: mathematics society, democratic study, thematic assignment, participative learning.

1. Introduction

Mathematics has been widely acknowledged as having a significant proportion in developing individual understanding of personal and social opinion, and life in society (Anthony and Walshaw, 2009). As well as socio-cultural in the community, physical environment is strongly affecting the student's attention, curiosity, and sincerity in studying mathematics. Classical mathematical-knowledge has a strong foundation in the society (Apple, 2004), and is a power and cultural asset against student's critical attitude and curiosity of learning mathematics. The critical attitude propelled by knowledge and the urge to understand more about natural phenomenon and the community's socio-cultural must be positively responded by formal education at school. Teachers have to improve awareness of social movement, history, culture, local and global socio-political force which later will impact student (Gutstein, 2006). The teacher's role is the most determining factor in developing the identity of mathematic study (Cobb and Hodge, 2002). If the teacher has various basic knowledge in mathematical community, then the teacher would be able to improve the ability of critical thinking, along with directing student to do critical learning-process and accumulate those experiences (Bratlinger, Buenrosto, Gutstein, and Mukhopadhyay, 2007).

The result of collaboration research by lecturer-students-teacher about thematic-assignment-based democratic learning (Medellu et al, 2015) concluded that: (1) thematic assignments that's been done by students in groups are able to motivate and increase students' productivity,(2) thematic assignments can build learning environment and democratic behavior which later will impact on student's interaction and productivity, (3) thematic assignments can strengthen concept with the context to students, (4) thematic assignments can develop the value of nature resource's utilization and environment's management.

The result proof that Mathematics learning can be interesting if students are confronted with environment. This result was also in accordance to what Boaler (2008) had said that students want Mathematics learning that's connected to their environment. Based on the result, this research is developed to integrate Mathematics knowledge in the society become formal material in the classroom or thematic assignments out of the class. Lattuca *et al.* , 2004 said that a learning that utilized various resources would build students' ability to organize and connect new information, constructing deeper scheme of knowledge. According to Piaget (in Bell 1970) someone's cognitive structure was formed by assimilation and accommodation processes. Assimilation is a process of getting new information and experience which will be directly merged with a person's mental structure, while accommodation means restructuring mental structure as a result of the new information and experience. Through thematic assignments by identifying nature and social phenomenon along with formulating mathematical-concepts networking with science concept, the students were enabled to have basic knowledge of Mathematics from parents or from social interaction in the society. Parent's participation is potentially strengthen children's learning process to become the process of strengthening value of society (Medellu et al, 2014).

Thematic assignment is a task that is being given to students in group to be a part of learning at school, but also can be designed as extra material and activity after learning hours which contributed to knowledge, skill, and some subjects' value. Thematic-interdisciplinary

activity can build a whole knowledge-skill-affection about problems or task themes, and at the same time builds a conceptual and procedural relations among subjects (Medellu et al, 2015). Related to Mathematics assignments, Hodge et al (2007) said that if students are interested in the assignments, they will develop the idea about the nature and learning of Mathematics. Assignments that confronting students with daily life in a complex system making the students to not only giving correct answers in Mathematics aspects but also applying Mathematics and the value in the life of society, thus contributing other disciplines (Anthony and Walsaw, 2009). Building connections between Mathematics concepts (and other disciplines' concept)is very important in comprehensively understanding thematic problems related to physical environments and socio-culture.

2. Research Methods

a. Stage of identifying factor of mathematical study in natural phenomenon and socio-culture. This factor identification of mathematics (and other subjects) is using format.
Theme:

Table 1. Identification of mathematical factor from nature and social phenomenon

Fact/phenomenon	Mathematics (and other subjects) learning factor	Formulation of networking concept	Formulation procedure based on the phenomenon process	Formulation of learning procedure
(1)	(2)	(3)	(4)	(5)

The observed fact/phenomenon in the first column is special part ofnature phenomenon or procedure/process in the socio-cultural activity.
The second column is identification process of subjects' concepts and procedures which can be applied or adapted to fact and phenomenon.
The third column formulates mathematical-concept networking (according to hierarchical concept and mathematical procedure) along with inter-disciplinary relationship.
The fourth column describes about nature process related to procedures (science and mathematics) as a reference for formulating thematic-assignment procedure.
The fifth column is the activity of identifying mathematical learning factors that has been done by research team (lecturers and students from Department of Mathematics and Science, Manado State University), teachers and local citizens (based on their skill/job, and experience).

b. The designation of interdisciplinary learning-activity (doing assignments) with the participation of parents and society. The designation of participatory study (parents and community) refers to the formulation of learning procedure (see column 5, table 1). According to their experience or skill, the parents and also society as well can participate as interviewees (based on knowledge and skill or related value) or as student's partner. As a process of participatory learning, a discussion had been conducted between children and parents, and between students group and society.

The related-research result (Medellu et al, 2004) showed that parents could participate as interviewees or partners for a productive learning in integrating student's experience outside their schoolwith the learning at school. In the identification and task designation, the roles and responds of students are evaluated.

Based on the result of fact/phenomenon identification, the material design and learning activity are being developed using the following format

Table2.Designing of material and learning activity

Characteristics of subjects				Material description	Methods and scenarios' choice
Concept/ principle /theory/law	procedure	Fact (general)	Context (local)		
(1)	(2)	(3)	(4)	(5)	(6)

3. Research Result

Based on identification result of some landslide locations as well as locations of potential landslide, a material design a thematic activity had been developed, covering 10 activities as following:

1) Activity -1 identifying various landslides
2) Activity - 2 analyzing landslide potential and combination of factors which affecting it
3) Activity -3 concluding impact level of cause factor in the village and surrounding locations
4) Activity –4 Identifying local ability, government's programs, and society's behavior related to landslide potential
5) Activity -5 Discussing basic concept of mathematics and landslide
6) Activity -6 Physics concept of landslide: object's movement on a slope surface
7) Activity -7 Discussing types of plant root and the function of roots to prevent landslide
8) Activity -8 Discussing the concept of energy alteration of landslide
9) Activity -9 Measuring land's declivity and determining landslide potential
10) Kegiatan-10 Discussing the landslide explanation using particular concept

Description of material design and learning activity (thematic assignment)

Activity 1. Identifying various landslides.

Characteristics of subjects				Material description	Choice of method and scenario
Concept/ principle/ theory/ law	Procedure	Fact (general)	Context (local)		

(1)	(2)	(3)	(4)	(5)	(6)
		Photos and videos of some landslides and the impact (material loss, death, etc.) and the information source.	Identifying local occurrence (within the village and places around it) and the causative factor of landslide.	• Identifying and comparing landslide within the own village and villages around. • Identifying information sources for lesson material.	• Discussion of students and parents/society about the landslides that had happened before and the causative factors. • Students group discussion to compare and synchronize the conclusion of students' discussion with parents/society .

Activity 2. Analyzing landslide potential and combination of causative factors.

(1)	(2)	(3)	(4)	(5)	(6)
		Analyzing information of landslide causes in other places, and level-impact classification related to landslide potential.	Analyzing causative factor toward landslide level compared to same occurrence in other places.	• Analyzing the impact of some factors' combination toward level/potency of landslide. • Making classification of various landslide potency based on criteria of causative factors.	• Students were discussing in groups to determine the relationship (effect) of factors to landslide. • Students were formulating various causative-factor combination toward landslide potency (based on the categories of very high-no potential).

Activity 3. Concluding the level of causative-factor's effect in the village and its surrounding

(1)	(2)	(3)	(4)	(5)	(6)
			Identifying causative factors of landslide in the village and the surroundings.	• Identifying causative factors in some locations within the village and the surroundings (the potency or occurrence). • Determining the order of causative-factors levels based on field observation.	• Students doing group observation accompanied by parents/community and identifying the impacts of factors and potencies. • Students discussing and formulating the impact level of potential factors toward landslide potency.

Activity 4. Identifying local wisdom, governmental program, and society's behavior related to landslide potency.

(1)	(2)	(3)	(4)	(5)	(6)
		• Regulation/governmental program about the controlling of landslide danger in other locations. • Local customs in other locations which decrease or increase the potency of landslide	• Local wisdoms related to prevention of landslide danger. • Regulation/governmental program about the controlling of landslide danger in the village.	• Identifying and clarifying local wisdom, governmental program, and society's activity for mitigating the landslide danger. • Identifying society's behavior against local wisdom and governmental program	• Student's discussion with parents about local wisdom, government's action, and community's activity which decrease the danger of landslide. • Student's discussion

				which affect in the increasing of landslide potency.	with parents about community's behavior impacting the increasing of landslide potency. • Students group discussion to integrate local wisdom, governmental program, and community's behavior.

Activity 5. Discussing the basic principle of Mathematics

(1)	(2)	(3)	(4)	(5)	(6)
The comparison of right triangle				• Discussing the basic concept: sine, cosine, tangent, etc. • Determining the length of the sides flanking the right angel, in a various no-angle bracket.	• Student studying the basic concept in the lesson book and thematic-assignments reference. • Students discussion (in group) filling the Student's Task paper.

Activity 6. Object's motion on the sloping surface

(1)	(2)	(3)	(4)	(5)	(6)
• Motion in sloping surface • Friction	Deciphering the gravity upon the components.			• Describing gravity in the objects in sloping surface and explaining the components parallel with the surface and vertical with sloping surface. • Describing normal force and friction. • Determining the enormity of friction in various slope angle.	• Students learned about the basic concept in the text book. • Students discussed about deciphering force on the surface. • Students discussed about determining the enormity of force component which pulling objects downward and friction which holds the objects. • Students discussed about the relation of coefficient of friction with critical angel, describing the relation between the coefficient and the enormity of critical angle and the sloping degree.

Activity 7. The type of plant roots and the functions to prevent/decrease the potency of landslide.

(1)	(2)	(3)	(4)	(5)	(6)
• Types of roots • Functions of		• Photos of landslide	• Students and parents/community's experience	• Comparing and analyzing the	• Student's discussion with parents/commu

roots to prevent/decrease the potency of landslide.		occurrence in other location caused by forest damage. • Photos of slope field save from landslide impact because of big trees.	about landslide which occurred because of damaging forest within own village or surrounding ones. • Plant root system and the potency to prevent or decrease landslide potency.	relationship between forest damaging and landslide occurrence (observation within the village and surrounding location and information in the mass media). • Analyzing the plant root system (types of roots, density, distribution, depth) and the function of infiltrating water and decreasing landslide potency. • Identifying plants in the environment and determining the potential of the plants to prevent landslide.	nity about the example of landslide within the village or in the surrounding village because of forest damaging and compare it to the same occurrence in other locations. • Student's discussion with parents/community about the plants that could prevent or decrease landslide. • Students group discussion about types of plant and the root system along with its ability to decrease landslide potency.

Activity 8. Energy and the landslide's energy change

(1)	(2)	(3)	(4)	(5)	(6)
• General form of functions and graphs • Energy of landslide related	Procedure of depicting the graph manually using excel program		.	• Pprocedure of depicting functions graph manually and using excel program. • Interpretation in general form of graph's function. • Energy change of landslide and the representing graph.	• Students discussed about the change in energy form during landslide. • Students discussed, interpreted, and

to degree of slope and soil layer's friction • Graph of energy change					determined the graph form of energy change. • Students discussed and interpreted the possibility of the existence or change of energy in the landslide or landslide-potential location, related to soil's slope andsoil layer's coefficient of friction.

Activity 9. Measuring field's slope and determining landslide potential in the location.

(1)	(2)	(3)	(4)	(5)	(6)
• Connected vessels in waterpass usage • Type of plants and the rooting	Measuring field's slope in on the field using simple equipment.			• Procedure and measuring skill of soil's slope on the field. • Identifying factors that affect landslide potency and comparing it inter-locations.	• Students group along with parents/society measuring soil's slope using simple equipment. • Students group identifying types of plants and field's condition, determining and comparing landslide potency inter-locations. .

Activity 10. Reporting assignments

(1)	(2)	(3)	(4)	(5)	(6)
					• Students group discussing and making summary of material and thematic-

					assignments, reflecting community's behavior, and committing to do positive things of preventing and mitigating landslide's danger.

Analysis result (tentative – because the learning activity is still ongoing) of students' learning activity in doing thematic-assignment about landslide:

Instructional activity in thematic assignments of landslide phenomenon. Students' involvement on communicating their experience about landslide integrated with material and thematic assignments showed that 60% of students were actively involved, thus encouraging learning enthusiasm along with building positive perception toward the design and learning activity, including Mathematics' expediency. Students' attendance during field activity was very good. The students' activity and productivity through discussion were also fairly good. The students' interview report about the participation level and learning productivity were motivated by Mathematics appliances, and the students were encouraged to solve problems through Mathematics procedure in the field.This result was in accordance to the result of Ainley *et al* (2006), Hodge *et al* (2007), Anthony and Walshaw (2009). The mastery of medians and variants in Mathematics concepts about the comparison of the sides of right triangle in determining surface's slope were 7.9 and 0.8, the procedure of measuring and counting surface's height and slope were 7.6and 0.82; determining the width of flat and slope surface 8.3 and 0.82. The concept mastery with landslide context (determining landslide potency, theoretical cause, and field's fact) shows rank-order coefficient with 0.78. This result showed that Mathematics concept and procedure could strengthen student understanding about landslide phenomenon and potency, and the comparison of field condition.

4. Conclusion

The development of instructional design of thematic assignments could motivate students and build students group initiative resulting in the increasing of activity and productivity. Students' group learning process which facilitated by teachers, researchers, and parents/society could increase students' learning interaction. Learning activity in the field which facilitated by teachers, researchers, and parents/society would strengthen the concept's mastery and thematic procedure, the connection of Mathematics-concept mastery with the context and the conceptual connection of Mathematics, Physics, and Biology.

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