

LIFE LABORATORY PROGRAM FOR ELEMENTARY SCIENCE HANDS ON ACTIVITIES (STRATEGIES AND INVESTIGATION IDEAS FOR SEMI URBAN SCHOOLS)

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Abstract

In learning, children have to be actively involved in meaningful and direct experiences. This classic idea advocates teachers to develop active hands-on involvement of children in their own learning. To achieve meaningful and direct experiences, children may be involved in laboratory instruction approach, which not only done in a room setting, but also in a natural surroundings. But unfortunately, some teacher as a facilitator of learning process doesn't optimally use natural environmental as sources, medium, and places for scientific investigation. Whereas most of *Madrasah Ibtidaiyah* (Islamic elementary school) in district area is located in an area with natural conditions that support to be explored. Teachers can develop a learning program that utilizes natural environment as a living laboratory. This study is a qualitative study that aimed to describe the program as part of science learning activities in *Madrasah Ibtidaiyah* in semi-urban environment. This typical school setting is a form the most madrasah ibtidaiyah in *kabupaten Ponorogo*. So, the purposes of this study are: 1) describing the living laboratory program's strategies for typical school, which include: the role of the teacher, the student's role, structure, stress, print materials, and manipulative materials; 2) analyzing investigation idea based on national curriculum for elementary science learning. Data for this study were obtained from various sources literary form of the book as well as the results of previous research on science learning which utilizing natural environment. Condition or the nature of *madrasah* in semi urban areas was obtained from observations and interviews as well as from school documents or the results of previous studies. The data were analyzed using qualitative data analysis using interactive model analysis technique developed by Miles and Huberman, consisting of three components of activities that are related to one another: data reduction, data display, and conclusion. The results of this study can be used by primary schools or *madrasah ibtidaiyah*, especially those in semi-urban areas, as a reference in developing science learning programs to take advantage of the surrounding environment. The results of this study can be further investigated to be applied and proved its effectiveness in schools learning process.

Key words: Living laboratory program, science hands-on activities, instructional strategy, elementary science learning.

INTRODUCTION

Indonesia has typical tropical climate which enable the people to interact with the natural surrounding all the year round. There are no extreme climate like high and low temperature which cause inhabitants to keep inside home all the day. This condition enable students to learn something hands-on from their surrounding, not only in classroom or laboratorium.

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experiences. This classic idea advocates teachers to develop active hands-on involvement of children in their own learning. To achieve meaningful and direct experiences, children may be involved in laboratory instruction approach, which not only done in a room setting, but also in a natural surroundings. But unfortunately, some teacher as a facilitator of learning process doesn't optimally use natural environmental as sources, medium, and places for scientific investigation. Whereas

most of *Madrasah Ibtidaiyah* (Islamic elementary school) in district area is located in an area with natural conditions that support to be explored. Teachers can develop a learning program that utilizes natural environment as a living laboratory.

So, the purposes of this study are: 1) describing the living laboratory program's strategies for typical school, which include: the role of the teacher, the student's role, structure, stress, print materials, and manipulative materials; 2) analyzing investigation idea based on national curriculum for elementary science learning.

Living laboratory by Life lab program idea began in 1978 in a small garden developed by students and teachers at Green Acres Elementary School in Santa Cruz, California. The idea grew and developed rapidly, attracting attention from other school districts, parents, universities, and community leaders. Since creating this first school garden, Life Lab has advocated the use of gardens as outdoor learning environments and as a means to create a sense of season and place for all children. A school garden puts the natural world at students' fingertips. This living laboratory—whether a planter box, an outdoor garden, or an indoor growing area—offers a rich context for exploring science, nutrition, social studies, math, art, language arts, and more.

Life Lab is a garden-based science program that integrates multiple curriculum areas around grade specific science concepts. The lessons are motivational in themselves and are flexible and open-ended, such that the class can expand on areas of interest or on topics where there is a lack of understanding.

Another program for life laboratory is school garden program (by California School Garden) is an innovative teaching tool and strategy that lets educators incorporate hands-on activities in a diversity of interdisciplinary, standards-based lessons. The garden engages students by providing a dynamic environment in which to observe, discover, experiment, nurture, and learn. It is a living laboratory where lessons are drawn from real-life experiences rather than textbook examples, allowing students to

become active participants in the learning process. Through the garden, students gain an understanding of ecosystems, an appreciation for food origins and nutrition, and knowledge of plant and animal life cycles. At the same time, they learn practical horticultural skills that last a lifetime (californiaschoolgarden.org).

The features Life Lab- Program in Green Acres School in California, are: 1) youngsters explore and practice science through a living laboratory (garden) that they have created; 2) children study such topics as soil, climate, and garden ecosystems by integrating concepts from physical, earth, and life sciences; 3) science themes such as cycles, changes, adaptation, and interdependence are stressed; 4) independent exploration and cooperative learning are used to help children build hands-on skills; 5) multiple disciplines, such as social studies and art, are integrated with the science experiences (Neuman, 1993: 243). From the features, it can be concluded that this program not only used for learning science matter but also can be integrated with another subjects.

The instruction ideas for life laboratory based on the fact that the students 'as a scientist' cannot manipulate variables and maintain control and experimental groups, and they rarely assume a causal relationship between variables. Rather, as a scientist, they observe naturally occurring phenomena and look for descriptive, comparative, and correlative trends and relationships (Cox et al, 2010: 30). Descriptive investigation involved describing parts of a natural system. The students explored descriptive question. Their work provided new descriptive insight into how living things behave during the change of seasons.

Comparative investigations are similar to controlled investigations. They may involve collecting and comparing data for different groups, organism, locations, or times. While correlative investigation involve measuring or observing two variables and searching for a pattern.

Madrasah Ibtidaiyah/MI (elementary Islamic School) in kabupaten Ponorogo

consist of the 7 public schools and 79 private schools. Most of the MI exists in semi rural area in some district of the region. Most of them still have green area as the surroundings, such rice fields, gardens, village squares, and ponds. The school' areas also enable them to build a special opened space for students to learn in it.

RESEARCH METHOD

This study is a qualitative study that aimed to describe the program as part of science learning activities in *Madrasah Ibtidaiyah* in semi-urban environment. This typical school setting is a form of *madrasah ibtidaiyah* in *kabupaten Ponorogo*.

Data for this study were obtained from various sources literary form of the book as well as the results of previous research on science learning which utilizing natural environment. Condition or the nature of *madrasah* in semi urban areas was obtained from observations and interviews as well as from school documents or the results of previous studies. The data were analyzed using qualitative data analysis using interactive model analysis technique developed by Miles and Huberman, consisting of three components of activities that are related to one another: data reduction, data display, and conclusion.

RESULT AND DISCUSSION

Strategies for Life Laboratory Program in Semi Urban-*Madrasah Ibtidaiyah*

The strategies for this program include: the role of the teacher, the student's role, structure, stress, print materials, and manipulative materials by considering some characteristics of Ponorogo's *Madrasah Ibtidaiyah*.

Role of Students. It is better for the children to be involved in a structured hands-on approach to inquiry skill development. This approach will guide the students in a structured way with laboratory worksheet. The program also include in school curriculum so will not bother the whole school's instruction. Most of MI's students come from children of surrounding inhabitants. They have social, emotional, and

physical connection with schools' environments. The fields, gardens, ponds may be the property of their relatives. This condition makes it easy for them to use it as learning sources support by teachers' recommendation.

Role of teachers. Teachers get involved in setting goals, guide children closely, heavily in vested in evaluating youngster. Teachers have to always try to find new resources for the students to learn in. this will adjust student motivation and pleasure to learn outside the classroom.

The structure of the program is moderate. Moderate here means that the program structure is adjusted to schools' structure. Some teachers have responsibility to the program viability; the head is fully in charge.

Resources. Many studies in natural science must be done in the natural environment, because the simple act of reproducing natural phenomena in the laboratory may distort how that phenomena occurs (Dvornich, 2010: 383). Everywhere there are unique resources for working with children in science. In rural area there are farm and forest. In urban areas there are zoological park and botanical gardens (Jacobson & Bergman, 1991: 176). With the typical semi urban school (as we can also say semi rural school), it can be reached the benefit of urban and rural resources. In typical area of *kabupaten Ponorogo*, the resources which can be used are: public parks, district garden, manufacturing planting area, field, garden, river, field irrigation, forest, grassland, commercial and natural fish pond, etc.

Print materials. To eliminate the unstructured lessons, at the early of the semester teacher get the students to make copy of the worksheets for all lessons in the semester of the program. Using the material, students can learned the based theory, the investigation phases, the observation table to be fill in, the conclusion box, pictures/sketch box.

Lesson approaches. The instructional activities of this program are in the form of field investigation, using process skill

approach. It engage some basic skill as observing, measuring, classifying, inference, predicting, and communicating, and integrated skills as identifying variables, constructing hypothesis, planning investigation, doing investigation, investigation analysis (Rezba, 1995).

While the investigation is done in the three type/approaches, they are: descriptive, comparative, and correlative. that the students ‘as a scientist’ cannot manipulate variables and maintain control and experimental groups, and they rarely assume a causal relationship between variables. Rather, as a scientist, they observe naturally occurring phenomena and look for descriptive, comparative, and correlative trends and relationships (Cox et al, 2010: 30).

Descriptive investigation involved describing parts of a natural system. The students explored descriptive question. Their work provided new descriptive insight into how living thing behave during the change of seasons. Comparative investigations are similar to controlled investigations. They may involve collecting and comparing data for different groups, organism, locations, or times. While correlative investigation involve measuring or observing two variables and searching for a pattern.

Instructional Investigation Ideas for Life Laboratory Program in Semi Urban Madrasah Ibtidaiyah

Instructional ideas for students’ investigation in this study considering the characteristic of schools’ environments condition and science subject matter based on curriculum’s contents. The area characteristic of the schools has been explained in the previous section, and have on some lesson strategies in study resources and integrated subjects. The ideas below state affirmatively where the investigation will be executed (in garden, field, pond, or others). The ideas also explain what science subject matters which have opportunity to be carried out based on students’ grade (do ‘the nature and form of objects’ than ‘magnetism and electricity’).

The newest Indonesian Education Curriculum (2013 curriculum/K13) shows some differences with the prior, especially for

elementary education. Scientific method are adapted in thematic approach. There is no science subject for K3 grade, but the science materials/scope are integrated in another subject.

The writer try to give idea for lesson instruction in the form of investigation activities. The idea described for different grade so that the teachers can get the idea easily to aply them in their classroom.

Here are the scopes of science material for grade 1-VI. The scope of grade I-II are: 1)body and senses; 2) plants and animals; 3)the nature and form of objects around; 4) the universe and the appearance for.

Science scopes for grade III-IV are: 1) the outer shape of the body of animals and plants; 2) the life cycle of living things; 3) plant propagation; 4) states of matter; 5) force and motion; 6) forms and sources of energy and alternative energy; 7) appearance of the earth and its amendments; 8) environment, the universe, and natural resources; 9) climate and weather.

Science scopes grade V-VI are: 1) skeleton and organs of humans and animals; 2) the food , the food chain and ecosystem balance; 3) the proliferation of living things; 4) adaptation by living beings on the environment; 5) health and human respiratory system; 6) and changes in the nature of things thermal conductivity, electrical, and magnetic; 7) solar system; 8) mixtures and solutions. (*Standar Isi Permendikbud tahun 2013*)

This paper adopted the three approaches in conducting lesson instruction, in the form of descriptive, comparative, and correlative observations for the field investigation model. The students ‘as a scientist’ cannot manipulate variables and maintain control and experimental groups, Rather, as a scientist, they observe naturally occurring phenomena and look for descriptive, comparative, and correlative trends and relationships (Cox et al, 2010: 30).

Table 1. Instructional of Investigation Ideas for Grade I-II

Scope	Investigation Question Ideas
Body and	Comparative:

senses	<ul style="list-style-type: none"> • is there any difference of surface of some leaves/soil/another objects Descriptive: <ul style="list-style-type: none"> • how many part of body do you/your friend have • how do you think about the surface of some object in the garden (smooth, rough, slippery) Correlative: <ul style="list-style-type: none"> • is there any relationship between the sense and and what do yo sense 	Scope	Investigation Question Ideas
Plants and animals	Descriptive: <ul style="list-style-type: none"> • how many plants grow in different part of the garden • what are the features of some plants and animal in the garden? Comparative: <ul style="list-style-type: none"> • is there any difference of the characteristic of some plants/animals lived in the garden (plant, bush, grass, insect, mamalia, aves) 	the life cycle of living things;	Descriptive: <ul style="list-style-type: none"> • what are the life phase of some animal (buterfly, cocroach, cat)? Comparative: <ul style="list-style-type: none"> • is there any difference of animals' life phase Correlative: <ul style="list-style-type: none"> • What is the relationship between the animals' life cycle and their kind?
The nature and form of objects around	Descriptive: <ul style="list-style-type: none"> • what are the nature of some objects/ the form of some objects Comparative: <ul style="list-style-type: none"> • is there any difference of the nature and form of some subjects in the playground; 	plant propagation;	Descriptive: <ul style="list-style-type: none"> • How does the plant in the garden propagate? (spinach, sweet potatoes, corn, sun flower, jusmine, rose) Comparative: <ul style="list-style-type: none"> • is there any difference of method of reproduction between some plant/ between vegetative and generative propagation Correlative: <ul style="list-style-type: none"> • What is the relationship between the circuntance and the success and failure of the propagation?
The universe and the appearance for	Descriptive: <ul style="list-style-type: none"> • how long are the sun shadow shown in the garden in the morning/noon/afternoon Comparative: <ul style="list-style-type: none"> • is there any difference of the sun shadow shown in the garden in the morning/ noon/ afternoon 	states of	Descriptif:

Table 2. Instructional of Investigation Ideas for Grade III-IV

<p>matter;</p>	<ul style="list-style-type: none"> • How does the state of matter of some objects in the garden? <p>Comparative:</p> <ul style="list-style-type: none"> • is there any difference in state of matter of garden objects 	<p>environment?</p> <ul style="list-style-type: none"> • What kind of sediment layers exist in under water (river/pond)? <p>Comparative:</p> <ul style="list-style-type: none"> • is there any difference of the benefit of natural resources in school environment? • Is there any difference of the rock hardness in the schoolyard/river/garden ? <p>Correlative:</p> <ul style="list-style-type: none"> • What is the relationship between the place and the sediment layer?
<p>forms and sources of energy and alternative energy;</p>	<p>Descriptive:</p> <ul style="list-style-type: none"> • What are forms of energy in school environment? • how is heat energy transferred to the wet chlotings/wet leaves? • What kind of alternative energy from the enviroment potential to be use? <p>Comparative:</p> <ul style="list-style-type: none"> • is there any difference of the use energy in different home based on its wide 	<p>climate and weather.</p> <p>Descriptive:</p> <ul style="list-style-type: none"> • How is the temperature of different place/time? <p>Comparative:</p> <ul style="list-style-type: none"> • is there any difference between temperature of difference places and time in the school garden? • Is there any difference of air flow shown in the windmill in different time of the day/ month? <p>Correlative:</p> <ul style="list-style-type: none"> • Is there correlation between month and the air flow? • ...between temperature and time/place?
<p>appearance of the earth and its amendments;</p>	<p>Descriptive:</p> <ul style="list-style-type: none"> • By observing the moon, students find how was the shadow of the earth move across the surface of the moon? <p>Comparative:</p> <ul style="list-style-type: none"> • is there any difference of type of earth gradation in some part of students neighbourhood? • ..Different effect of erotion by rain, heavy rain, and wind in some place of the garden? <p>Correlative:</p> <ul style="list-style-type: none"> • What is the relationship between: the shape of earth gradation and its factor 	
<p>environment, the universe, and natural resources;</p>	<p>Descriptive:</p> <ul style="list-style-type: none"> • What color is made by the white sun light? • List some natural resources in the school 	

Table 3. Instructional of Investigation Ideas for Grade V-VI

Scope	Investigation Question Ideas
<p>skeleton and organs of humans and animals;</p>	<p>Comparative:</p> <ul style="list-style-type: none"> • is there any difference of skeleton form of some died animals? <p>Descriptive:</p> <ul style="list-style-type: none"> • how was the shape of skeleton of died things found in the garden (butterfly, caterpillar,

<p>the food , the food chain and ecosystem balance;</p>	<p>etc) This scope are best practice idea to be conducted in life laboratory program. Descriptif: <ul style="list-style-type: none"> • how was plant and small animal behave on the change of temperature • what are the features of some plants and animal in the garden? Comparative: <ul style="list-style-type: none"> • is there any difference of: plant grow in different light intensity, different amount of water, different type of soil, vegetation on the plowed and in the surrounding area, Correlative: <ul style="list-style-type: none"> • is there any relationship between : light and growth direction, water amount and plant growth, sources of water and direction of root grow </p>	<p>adaptation by living beings on the environment;</p>	<p>the success and failure of the propagation? Descriptive: <ul style="list-style-type: none"> • What are the adaptation of some plants that live in environments? • How much water can lichen absorb? Comparative: <ul style="list-style-type: none"> • is there any difference of: characteristic of different plant/animal that live in different kind of environment in garden/field, Correlative: <ul style="list-style-type: none"> • What is the relationship between: shape of beak and animals' food, kind of leaves and its function </p>
<p>the propagation of living things;</p>	<p>Descriptive: <ul style="list-style-type: none"> • How does the plant in the garden propagate? (spinach, sweet potates, corn, sun flower, jusmine, rose) Comparative: <ul style="list-style-type: none"> • is there any difference of method of reproduction between some plant/ between vegetative and generative propagation Correlative: <ul style="list-style-type: none"> • What is the relationship between the circumtance and </p>	<p>changes in the nature of things</p>	<p>Descriptive: <ul style="list-style-type: none"> • What happen when liquid change into a gas, water under the sun heat all the day? Comparative: <ul style="list-style-type: none"> • is there any difference of : forms of the same object in the garden/river, nature of wood in difference place, nature of rice/bread in different time, amount of water after get the sun heat all the day </p>
		<p>solar system;</p>	<p>Comparative: <ul style="list-style-type: none"> • is there any difference of: the planet big in the solar system? • what subject in the garden and playground can be use as scale model for the planet in solar system? </p>

- mixtures and solutions
- Descriptive:
- how is the shape of mixed and solution from the material got from garden?
- Comparative:
- is there any difference of: the form of mixture and solution which made from the garden materials

From some type of questions of investigation ideas above, the comparative model demonstrates that all three types of investigations involved essential features of scientific inquiry. This idea in line with what Dvornich et al (2010: 388)) said that comparative studies can be targeted as an important schools' instruction emphasis because of the similarities they share with descriptive and correlative studies.

CONCLUSION AND SUGGESTION

The strategy of the life laboratory program which meet the characteristic of *Madrasah Ibtidaiyah* (MI) in kabupaten Ponorogo is mainly supported by the condition of most of the school that is located in semi rural area. By this condition, the school is near from natural surrounding like field, garden, pond, and river. The school also has big opportunity to create its own garden as private life laboratory for its students.

As the school apply national curriculum (K13), so the program is being part of thematic approach lesson instruction. Science lesson is not the only subject to be learned in the garden or in other natural surroundings, yet it is integrated with another subject like math, literature, physical exercise, social science, civic education, and arts. In MI, the lesson also can be integrated with Islamic studies, since all the students are Muslims.

Investigation ideas can be formed in three approaches, descriptive-comparative-correlative. The investigation starts with some questions according to the aim of the lesson instruction. This study only focused on

science hands-on investigation activities. The next study can integrate other subjects, non science matter, to be learned together in school natural surroundings.

The results of this study can be used by primary schools or *madrasah ibtidaiyah*, especially those in semi-urban areas, as a reference in developing science learning programs to take advantage of the surrounding environment. The results of this study can be further investigated to be applied and proved its effectiveness in schools learning process.

REFERENCES

- Neuman, Donald B. 1993. *Experiencing Elementary Science*. California: Wadsworth Publishing Company.
- Carin, Arthur A. 1993. *Teaching Science Through Discovery*. New York: Macmillan Publishing Co.
- Cox, Jonas, et al. 2010. "A Model for Field Investigation in The Science Classroom". *Washington Science teachers' Journal*, Vol 51, No.2, 30.
- Dvornich, MWK, et al. 2010. A Comparative Model of Field Investigation: Aligning School Science Inquiry with the Practices of Contemporary Science. *School Science and Mathematics* Vol 107 (1), 382-390.
- Jacobson, Willard J. and Bergman, Abby Barry. 1991. *Science for Children A Book for Teachers*. Boston: Allyn and Bacon.
- Myers, Brian E. dan Dyer, James E. 2006. Effect of Investigative Laboratory Instruction on Content Knowledge and Science Process Skill Achievement Across Learning Styles, *Journal of Agricultural Education* Vol 47 (4), 52-63.
- Rezba, Richard J., et.al. 1995. *Learning and Assessing Science Process Skill*. Iowa: Kendall/Hunt Publishing Co.
- Smith, Lienna Linn. 2001. *The Integration of a formal garden Curriculum Into Louisiana PublicElementary School*.

Thesis of Department of Horticulture
Louisiana State University.

Widayanti, Esti Yuli. 2015. *Keterampilan
Proses Sains Dasar Kelas Atas MI
Mitra STAIN Ponorogo*. Research
Report of STAIN Ponorogo.

Standar Isi Permendikbud tahun 2013

Soil Stories Life Lab Science Program. 2007.

Depdiknas. 2008. Proses Pembelajaran di
Kelas, laboratorium, dan di Lapangan

Garden for Learning. csgn.org (California
School garden Network)

lifelab.org

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2014. Bapeda Kabupaten Ponorogo.