ICEE-2

A Portrait of the Engineering-Oriented Natural Science Lesson Plan for Teaching and Learning in 5th Grade Elementary School of Elementary Laboratory UPI Bandung

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Abstract. Lesson plan (RPP) serves as a reference for teachers in implementing the teaching-learning in the classroom. Teachers write lesson plans based on the syllabus that engage students in learning to achieve basic competency curriculum. STEM learning approach has been implemented in primary schools. Engineering as one unit STEM believed to provide insight into the processes and systems that are used to make products of technology, because engineering is an approach to designing interactive objects, learning processes, and systems to meet human needs. This study aims to determine: (1) how the teachers write engineering-oriented lesson plans, (2) the constraints faced in the implementation of the lesson plan teachers in learning science, and (3) the efforts of teachers in overcoming the implementation of the RPP in science learning. This study uses qualitative research and descriptive research. The research subject were 1 teacher and 22 students of class V SD Laboratorium UPI Bandung 2018/2019 school year. Data obtained from interviews, observation and documentation in the form. Data were analysed using data reduction, data presentation and conclusion. The results showed although teachers write engineering-oriented lesson plans and executed in sciece classroom teaching-learning, students have difficulty identifying the problem. Poorly trained students to brainstorm and visualize ideas so difficulty determining the necessary tools and materials. Students have a difficulties to create design, and realize the design. Thus, students become less able to reflect on the results of testing the design to improve the design.

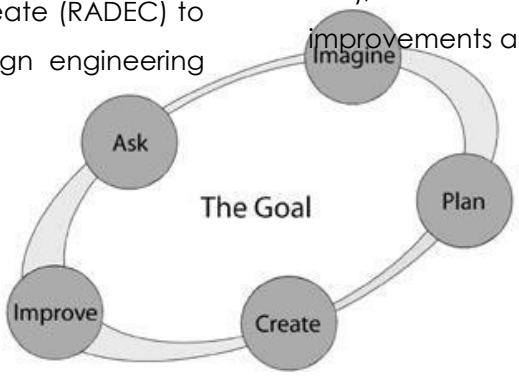
Keyword: Lesson Planning, Engineering, Process Engineering Design, Science Education, Elementary Classroom

INTRODUCTION ~ After the introduction of the world's STEM Education, the question arises at a primary school teacher, whether engineering approaches can be applied to all students. The teachers questioned the possibility that suitable engineering applied in conditions of inclusive classrooms, where children with special needs can be engaged in learning. Engineering can be applied to science teaching in inclusive classrooms. Has conducted a study of 20 students 3rd grade about the practice of engineering, process engineering design through the design project vane windmill. The findings showed that 7 of the 20 students in need of guidance read the literature, and one person require planning guidance. It can be concluded that the various strategies used by teachers, can help students achieve competency engineering design (Lottero-Perdue, PS, Lovelidge, S., & Bowling, E, 2010).

Bridges for applying engineering approaches to learning is through the development of lesson plan. Lesson plan (RPP) according Permendikbud Number 22 Year 2016 About Standard Process Primary and Secondary Education is planning to-face learning activities for one meeting or more (Education K, 2016). RPP developed from the syllabus to guide student learning activities in an effort to

achieve basic competencies (KD). Every educator in the educational unit is obliged to draw up lesson plans complete and systematic so that learning takes place in an interactive, inspiring, fun, challenging, efficient, motivating students to actively participate and provide enough space for innovation, creativity, and independence in accordance with their talents, interests, and physical and psychological development of students. RPP is based on KD or subthemes held one or more meetings. Engineering approach through proper learning models can strengthen the skills of the engineering design process. Selection of the model study to fit such a model of learning Read-Answer-Discuss-Explain-Create (RADEC) to practice the skills of design engineering process needs to consider the needs of curriculum and content knowledge that the final goal of learning to not forget the achievement of competency standards (SKL) which will be tested by a national examination (Sopandi, 2017)

Trained engineering process design skills to students through five cycles of EIE (Engineering is Elementary) introduced by the Museum of Science Boston USA (Lachapelle, & Cunningham, 2010). The fifth cycle is Ask (defining the problem and identifying constraints); 2. Imagine (brainstorming ideas and choose the best); 3. Plan (drawing diagrams and collect materials); 4. Create (follow the plan and test); 5. Increase (discussing possible improvements and repeat steps 1-5).



Engineering design process EIE method (Cunningham, 2009)

The importance of the engineering approach in elementary school, the inventor of the method described by EIE (Lachapelle, & Cunningham, 2014) is to help students understand the world around them and man-made objects. Skills are important as stepping literacy technology in primary schools are: a) Knowledge (know about): engineering and what technology was developed by engineers, various engineering, everything that has been made in human civilization as a result of the engineering development, problems engineering has a variety of solutions, how engineering affects the community, and society affect engineering, how technology affects the world both positively and negatively too, engineers from different nationalities and have different skills; b) Skills (can do): perform the engineering design process,

METHOD

This study uses qualitative research and descriptive research. The data source in the study of one teacher and 22 students of class V SD Laboratory pilot UPI, Bandung academic year 2018/2019. RPP theme 1 of organ motion of animals and humans.

Data obtained from interviews, observations using the observation instrument PORSD (Elementary School Engineering Observation Protocol) (Chaerun A., Sopandi, W., S. Udin, Wiwi T., Hendi I., 2019), and supported by documentation in the form of video currently learning activities. Data were analysed using data reduction, data presentation and conclusion.

RESULT

Our checklist has three parts. The first part offer section with the way teachers plan learning implementation (RPP) engineering oriented. The second part offer section withobstacles encountered in the implementation of the lesson plan teachers in engineering-oriented science teaching, The last part offer section with the efforts of teachers in overcoming obstacles in learning science RPP implementation.

Presentation of the data on the percentage of respondents to each of the foregoing issues and the pertinent discussion follows.

Table 1. Percentage Responding to obstacles encountered in the implementation of the lesson plan teachers in science teaching oriented engineering

EIE EDP	Description	Students N = 22			
		Oft	Occ	Cell	Nev
Ask	Identify the problem	45.45	54.55	15.3	
	Determine design constraints	54.55	45.45	-	-
	Consider relevant prior knowledge	54.55	45.45	-	-
Imagine	Brainstorm design ideas	45.45	54.55	-	-
	Draw and label Reviews those ideas	54.55	45.45	-	-
Plan	Pick one idea	50.00	45.45	-	4:55
	Draw and label the idea	59.09	36.36	-	4:55
	Identify needed materials or conditions	54.55	45.45	-	-
Create	Carry out the plan	50.00	50.00	-	-
	Create the design	54.55	45.45	-	-
	Test the design	45.45	54.55	-	-
Improve	Reflect on testing results	50.00	54.55	-	-
	Plan for, Create, and test a new (improved) design	31.82	54.55	-	18:18

Oft, Occ, Tues, Nev are the options Often, Occasionally, Seldom, Never

Reporting table 1, at least fifty-one point five percent (48.5%) of the students indicate Often they identify the problem of the Ask category. These are: Identify the problem (45.45%), Determine design constraints (54.55%), relevant priors Consider knowledge (54.55%).

About fifty percent (50%) of the students indicate Often they identify the problem of the imagine category. These are: Brainstorm design ideas (45.45%), Draw and label Reviews those ideas (54.55%).

About fifty-four point five percent (54.5%) of the students indicate Often they identify the problem of the Plan category. These are: Pick one idea (50%), Draw and label the idea (59.09%), identify needed materials or conditions (54.55%).

Around fifty-two-point three percent (52.3%) of the students indicate Often they identify the problem of the Create category. These are: Carry out the plan (50%), Create the design (54.55%), Test the design (45.45%).

At least forty-two-point four percent (42.4%) of the students indicate Often they identify the problem of the Improv category. These are: Reflect on testing results (50%), Plan for, Create, and test a new (improved) design (31.82%).

How the teacher handles the obstacle of the engineering approach in teaching and learning of Science in 5ft grade are shown below on the table 2.

Table2. Teacher effort to Overcome the obstacles of applying the engineering approach

EIE EDP	Description	Teacher N = 1
Ask	Identify the problem	Teachers apply the use of any pre-study before the study conducted and students respond independently and discussion
	Determine design constraints	
	Consider relevant prior knowledge	
Imagine	Brainstorm design ideas	Teachers facilitate students with graphic design that serves as triger ideas while encouraging students to build his own
	Draw and label Reviews those ideas	
Plan	Pick one idea	Teachers facilitate the students in the group to select ideas, describe, and determine which tools and materials
	Draw and label the idea	
	Identify needed materials or conditions	
Create	Carry out the plan	Teachers assist students create a design, implement design and test design
	Create the design	
	Test the design	
Improve	Reflect on testing results	Teachers familiarize students to evaluate the design through the reflection of the test and improve the design by using data obtained from the test results.
	Plan for, Create, and test a new (improved) design	

DISCUSSION

The results showed (1) teachers write lesson plans and executed engineering-oriented teaching and learning activities.

(2) the constraints faced by teachers, among others: Students are hard to identify problems and determine design constraints (limitations of the materials used for the lack of prior knowledge (scientific concepts); Students are not trained to brainstorm and visualize ideas so difficulty determining the tools and materials necessary, create difficulties students design, test design, and realize the design; students are less able to reflect

on the results of testing the design, improve design.

(3) the efforts of teachers in overcoming obstacles, among others: Teachers apply the use of any pre-study before the study conducted and students respond independently and discussion; , Teachers facilitate students with graphic design that serves as trigger ideas while encouraging students to build his own; Teachers facilitate the students in the group to select ideas, describe, and determine which tools and materials; Teachers assist students create a design, implement design and test the design; Teachers familiarize students to evaluate the design through the reflection of the test and improve the design by using data obtained from the test results.

CONCLUSION

EIE cycle engineering design process can be properly implemented in the classroom through engineering approach, when the teacher is able to create a lesson plan that detail leads students on steps using the pre question of learning to independently able to identify the problem. Students can further define the problems and overcome the obstacles that arise in devoting his ideas and able to choose the best ideas are used as a design plan. Furthermore, students are able to describe the design and designing tools and materials which needed with planned completion of the project. To further students can test and use the test data to improve the design the better.

The ability of the engineering design process for elementary school students is the foundation of thinking to think creatively produce as output creativity.

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