

# Primary School Teacher Strategy to Promote Student Engagement in Science Lessons

Irwan Koto  
Postgraduate Program of Elementary  
Education, Bengkulu University  
Bengkulu, Jl. WR. Supratman,  
Bengkulu 38371, Indonesia  
\*koto\_irwan@yahoo.co.id

Muslima Harneli  
Public Elementary School Number 3,  
Bengkulu Tengah  
Bengkulu, Indonesia

Endang Widi Winarni  
Postgraduate Program of Elementary  
Education, Bengkulu University  
Bengkulu, Jl. WR. Supratman,  
Bengkulu 38371, Indonesia

**Abstract**—It is believed that student engagement is significantly associated with student interest and academic performance. This study reports the primary school teacher strategy to promote student engagement in science lessons to enhance student academic performance. There were 24 students in the fifth grade, one classroom teacher, and two teacher trainers involved in the collaborative action research. The intervention was implemented in two cycles comprising; idea, planning, implementing, evaluating, amend planning, and implementing. The data collection instruments are paper and pencil test, classroom observation checklists, and teacher reflective journals. An action plan was designed for 70 minutes a day on 2 days a week for a period two weeks. In the intervention process, the classroom teacher implemented the action plan using learning cycle 3E model combined with KWL techniques to promote student engagement. Following evaluating, the teacher implemented the amended plan employing learning cycle 3E model combined with POE techniques. The findings showed that in term of behavioral and cognitive engagement learning cycle 3E model blended with POE technique was more effective than learning cycle 3E model belended KWL technique.

**Keywords**—Engagement, learning cycle model, POE technique, KWL technique, action research

## I. INTRODUCTION

Regardless of considerable variability in meaning given to term of engagement by scholars, engagement is a multidimensional concept. Over the past two decades, a growing body of research on student engagement stated that students' academic achievement in schools are affected by their engagement in learning in classroom [6]. In light of the previous statement, student engagement in

their science lesson has strong association with the ability to comprehend science concepts and to develop science process skills.

There are five features of lesson that seem to have enhanced students' engagement in the lesson; relevance of the lesson; student-centeredness of the lesson; opportunities to engage students; the cognitive level of the tasks, and the effective relevance of the lesson [3]. To provide the science lessons which engage students in learning activities, there are three efforts which can be implemeneted in teaching and learning process, namely developing lesson relevant to students' interests; minimalizing to practice the transmissive pedagogy; and making science less difficult [14].

This current study was intended to portray the teacher's strategy to promote students in learning science. The teacher as decision maker in classroom is in charge of determining the appropriate methods, techniques, and procedures for students. In other word, the study focused on how classroom teacher employs methods, techniques, and procedures to assist student learning. Consequently, the teacher needs to choose the most suitable teaching strategy to promote students' engagement.

*Student engagement in science lesson*

By employing the theoretical framework named as "organizing heuristic or taxonomy" and proposed by [2], student engagement perceived as "multiple-dimensional construct" containing four subtypes; academic, behavioral, cognitive, and psychological respectively. Each subtype is designated by multiple indicators as depicted in **Table 1**.

**Table 1.** Engagement Subtypes and Its' indicators

Student Engagement <sup>*)</sup>			
<i>Academic</i>	<i>Behavioral</i>	<i>Cognitive</i>	<i>Psychological</i>
<ul style="list-style-type: none"> <li>▪ Time on task</li> <li>▪ Credit hours toward graduation</li> <li>▪ Homework completion</li> </ul>	<ul style="list-style-type: none"> <li>▪ Attendance</li> <li>▪ Classroom participation (voluntary)</li> <li>▪ Extracurricular participation</li> <li>▪ Extra credit options</li> </ul>	<ul style="list-style-type: none"> <li>▪ Self-regulation</li> <li>▪ Relevance of school to future aspirations</li> <li>▪ Value of learning (goal setting)</li> <li>▪ Strategizing</li> </ul>	<ul style="list-style-type: none"> <li>▪ Belonging</li> <li>▪ Identification with school</li> <li>▪ School membership</li> </ul>

A review of relevant literatures pointed out the indicators of cognitive engagement indicated predominantly by self-regulation and value of learning and behavioral engagement was reflected by student participation in classroom and in school (Fredrick, Blumenfeld & Paris, 2004). Pertaining to the subtypes of student engagement shown in Table 1, the focal point of the study are behavioral and cognitive engagements. Since many studies reported that there are a significant correlation between students' active engagement and academic achievement mediated by students' self-efficacy and teacher support for learning [5]. *Effective Teaching for Supporting Students' Engagement*

The terms of "effective" is used interchangeably in many earlier studies with "good", "exemplary", "excellent", great, and "quality". These terms are attached to teaching or teachers. For example, Nasser-Abu Alhija (2016) preferred to utilize "good teaching" rather than "effective teaching" through students' conceptions. In contrast, Walker (2008) used "effective teacher" to identify the characteristics of effective teacher. In this study, the expression of effective teaching is applied to represent these concepts.

The criterion of effective teaching used by several researchers is based on the effective implementation of pedagogical methods (Hénard & Rosereare, 2012) that guide students to have students' learning outcomes. In addition, [12] stated that good teaching stimulates not merely to understand the subject matter, to have the range of skills and abilities but also to develop attitudes. In fact, education researchers have long been tried to identify the prominent characteristics of effective teacher that contribute to student achievement. *What Teacher Strategy can be Employed?*

In the light of the above question, this study expose some teaching strategies via different learning activities that enable teacher to implement in classroom for achieving the intended aims. As stated by Wandberg (2011), during instruction teachers can employ the various teaching strategies such as methods, techniques or procedure to assist student learning. In this study the 3E (Exploration, Explanation, Expansion) learning cycle was employed with the POE (Prediction-Observation-Explanation) strategy and the KWL (The Know-Want-Learn) Strategy strategy

As pointed out by [1], the 3E learning cycle is an inquiry-based instructional strategy which splits instruction into three stages. First, in the exploration phase, students are presented experience with the science concept to be elaborated, usually incorporating hands-on experiences. Second, in the explanation phase, the students guided by teacher direves the science concept from the data through a classroom discussion. Third, the expansion phase provides students the opportunity to explore the application of the concepts into new situation. The use of cooperative learning activities (Nicolò, 1994) in the 3E L-C lesson

created a greater sense of student control and heightened student self-esteem.

The base of POE procedure is the classic model of research where a hypothesis is stated and the reasons are given for why this may be true, relevant data are gathered and results are discussed (White & Gunstone, 1992). Procedures generally uses observable, real-time events as stimuli to provoke student thinking about the intended concepts. Tasks which used this procedure are referred to POE tasks which involve students in predicting the results of a demonstration; observing the demonstrations and explaining any discrepancies between their predictions and observations. POE strategy is an effective instructional means that engage students in learning and strengthens their understanding of science concepts through the use of demonstrations [10].

Since the KWL strategy, a graphical organizing instrument, had been introduced by [7] as a reading-thinking strategy which promote the students as active learner in reading a text, many scholars as Foote, Vermette, and Battaglia (2001) reported that the KWL reinforces student-centered- learning and it can be exercised in any subject area. In addition, learning activity that implement the KWL strategy enable to enhance comprehension and summarizing abilities as well as students' self concepts [7].

The KWL strategy comprises three stages; retrieving prior knowledge; deciding what wanted to be learned; recollecting what is learned (Blachowicz & Ogle, 2008). There are three activities that can be carried out by students during reading a text, namely, before reading, during reading and after reading. These activities can be organized in a form of the KWL chart which is utilized successfully to stimulate students' inquiry (Ogle, 2009). Tok (2013) reported that the employing of KWL strategy in the sixth graders was effective in enhancing the students' mathematics attainment and metacognition. Therefore, the KWL strategy is appropriate to be exercised for elementary school students.

## II. METHOD

Action research methodology was used to collect data. Action research is a form of practice which involves data collecting, reflection on the action as it is presented through the data and making claims to knowledge based on validated evidence (McNiff & Whitehead, 2002).

The choice of research methods was justified by need for the approval of teaching strategy that make students engage in learning science actively. Action research encourages the use of a range of techniques in order to look at what is happening from a variety of angles and point of view while monitoring intended and unintended outcomes of actions. Most action research studies have a built-in spiral of activity (Weiner, 2003) as shown in **Figure 1**.

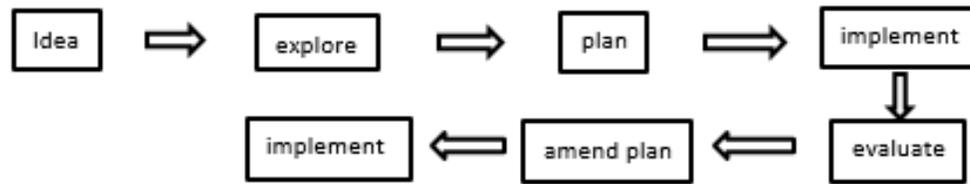


Figure 1. Spiral Cycle of Action Research

### Subjects and School Contexts

This Classroom Action Research (CAR) took place at public elementary school located in rural area Bengkulu Tengah (Indonesia). This school houses about 192 members consisting of 176 students (54% boys and 46% girls), 13 teachers and 3 administrative staff. The majority of students (86%) who come into schools from low-income families. Students attend the classes from Monday to Friday and lessons begin at 7:30 AM and end up at 13.30 PM, excluding the 1<sup>th</sup> and 2<sup>nd</sup> grades. The class involved in this CAR is the 5<sup>th</sup> grade which is composed of 24 students; 16 girls (67%) and 8 boys (33%).

The Ministry of Education via local government provides the student tool kits for hands-on activities, teacher's books and student's book. Since the science books are only used in class, students are not allowed to bring at home. Due to lack of books, and each student has to share it with their peers, which is seated near. Students' seating are arranged conventionally and students' desks are located within the classroom in 4 rows.

### Initial Reflection

We (author 1 and author 3) observed teaching and learning process while science subject was delivering. Throughout these classroom observations, we perceived different aspects to be upgraded for the 5<sup>th</sup> grade students such as misbehavior, reluctant students who are not willing to work, disrespectful learners and issue related to students' attention. Because students can focus on lesson only for 10 minute, they get easily interrupted such as they stand up, walk around, talk to their peers, ask permission to the toilet, and soon. It is challenging task to keep students' attentions to the lesson. In fact, students are participative when the teacher create activities or employ real objects which can attract student's interest and attention. Though, the learning activities occur in short time and not sufficient to preserve them all focused. Therefore, the teacher's problem depends on her teaching practices because she has not yet found the methods or strategies to maintain students focused on the lessons. Consequently, it is urgent to find out new teaching strategies that help the teacher who has 15 years teaching experiences in elementary school to promote students' engagement in the science lesson.

### Data Collection Instruments

In this study, teacher reflective journal, classroom observation checklist and science knowledge test were utilized to collect data. Qualitative data was generated from teacher's journal and classroom observation. Also, quantitative data was accumulated from paper-pencil tests. Validity or credibility was addressed through the triangulation of data sources, including teacher's journal, classroom observation and test [6].

The science knowledge test was administered to examine student knowledge prior to and following intervention. The test consisted of 20 multiple-choice test which encompass low and moderate order thinking based on Bloom's taxonomy; knowledge, comprehension, and application. The validity of test referred to content validity which was based on National curriculum and science textbook. The Cronbach's alpha coefficient of 0,72 revealed that test satisfied the requirement for reliability.

Classroom observation checklist was developed to be suitable for the stages of 3E learning cycle. Teacher's instructional strategy and students' activities were observed as students participated in the work group activities with special attention being focused on how teacher promote students' engagement in science learning.

### Procedure

Based on the evidences collected in initial reflection, the teaching strategy considered to enable to promote student engagement in science lesson was introduced to the teachers. The first and third authors gave the explanations and training concerning to why and how to implement the 3E learning cycle blended with the POE and KWL strategy in teaching science lessons. After the training had been conducted in two weeks, the team analyzed curriculum and syllabus to create lesson plans and assessment, students' work sheet, and media for learning (books, real objects, poster) to support the intervention.

As mentioned in the method section, this study was designed as the CAR approach. The intervention was done collaboratively by following the cycle process of identifying and seeking the solution to classroom problems faced by the 5<sup>th</sup> grade teacher. The findings was not intended to generalize or to prove the basic truth of a learning theory.

The processes of how the teacher implemented teaching strategy observed by two observers by using the classroom observation protocol. During the evaluation, all information gathered from teacher’s journal and classroom observation were analyzed collaboratively by research team to create the second plan.

*Data Analysis*

Evidences collected from teacher’s journal and classroom observations were analyzed by using content analysis. Quantitative data was evaluated with using the descriptive statistics such as frequency (cumulative percentages), mean and standard deviation.

**Table 2. Basic Competences, Learning Indicators, and Teaching Strategy**

Basic Competences*)	Learning Indicators	Teaching Strategy
Describe human beings and animals dependences on green plants for food	a. Identify parts of plants as food sources for human beings and animals	3E learning cycle method blended the
	b. Explain green plant to be needed by human being and animals as energy sources	KWL techniques
Identify different type of animals adaptations to their environment	a. Understand what a structural adaptation is	3E learning cycle
	b. Understand what a behavioral adaptation is	method blended the
	c. Describe which adaptations various animals developed	POE techniques

Note \*): source from National Curriculum (2013)

Before intervention, the pre-test was administered to determine a baseline of students’ current knowledge. At the end intervention, students took the similar test to look at the effectiveness of teaching strategy to foster student engagement. As shown in table 3, the post-tes mean score was higher than the pre-test mean score ( $89.58 \pm 1.93 > 58.23 \pm 2.26$ ). Mean gain score ( $31.35 = \text{mean score post test} - \text{mean score pre test}$ ) indicated the implementation of combined learning cycle method with the POE strategy in the cycle I and the combined learning cycle method with the KWL strategy in the cycle II was effective in terms of achievement test score. Intentionally, this study report, however, is not intended to differentiate between both of methods. The enhancement of student test score from before to after intervention confirmed that there are association between active engagement and the ability to understand science concepts [2]. This also supported a robust relationship between academic achievement and cognitive engagement (Greene & Miller, 1996).

*The Cycle I:*

In the cycle I, the teacher practices teaching strategy to engage students for learning in science lesson by employing the 3E learning cycle combined with the KWL strategy. By utilizing classroom observation protocol, two observers look at how teacher perform her teaching strategy to keep student engagement in learning process, particularly behavioral engagement; student interaction with peers and teachers; students participation in learning activities; attentiveness; and positive conduct.

**III. RESULTS AND DISCUSSION**

To achieve the research aim, “how does the teacher implement the most suitable teaching strategy to promote students’ engagement in science lesson”, the study specify the indicators of student learning for guidance to select methods, techniques and procedures to achieve educational objectives. Table 2 presented the basic competences, learning indicators, and teaching strategy which was implemented during the intervention. The research team make lesson plan by referring to **Table 2**.

**Table 3. Students’ performance prior to and following intervention**

Score	Pre test (N = 23)		Score	Post tes (N = 24)	
	Freq	%		Freq	%
70	6	26	100	6	25
60	9	39	95	5	20
50	6	17	90	6	25
40	2	8	85	4	17
			80	2	8
			75	1	5
Range	30		Range	25	
Mean	58.23		Mean	89.58	
S.D	2.26		S.D	1.93	

Note: the range of score from 20 item test is from 0 to 100.

Recently, the use of classroom observation is commonly applied to measure behavioral engagement related to teacher and student interaction [13]. Since engagement are both observable and salient, behavioral componens observed and recorded from classroom observation checklist enabled to portray students’ engagement. Table 3 depicts teacher’s strategy observed by two observer during the intervention in the first cycle.

**Table 4. Teacher’s strategy recorded by using Classroom Observation Checklist**

Stages of 3E LC and the KWL strategy	Teacher Behaviors: <i>What Teacher Should Do..</i>	Recorded by	
		Observ 1	Observ 2
Exploration	1. present a stimulating experience that will engage the students’ interests about the topic “human being and animal need green plants for food”.	√	X
	2. by using a stimulating experience, guide students to state the problems to investigate cooperatively in groups.	√	√
<i>What I Know</i>	3. direct students to recall their prior knowledge about problem and write their idea in the first column of the KWL chart.	√	√
<i>What I Want to know</i>	4. have students discuss in group what they like to know about problem and write down in the second column of the chart.	√	√
<i>What I Learned</i>	5. Ask students to write what they have learned from the reading in the third column of the KWL chart.	√	√
Explanation	6. Give an opportunities for groups to present their KWL chart	√	√
	7. Ask for clarification or justification about student presentation	√	√
	8. Provide definition, new words, and explanation for the technical terms and definitions.	√	√
Expansion/ Application	9. Provide opportunities for students to apply new concepts and skill and to extend them to other contexts.	√	√
The percentage Agreement of two observer (observ)		89%	

Note: √ is indicated as “observable (=1)”; x indicated as “not observable (= 0)”.

*The cycle II.*

Using the evidence from teacher’s journal and classroom observation check list, team research were carried out the reflection to amend the plan which was

implemented in the cycle I. Table 4 shows how the teacher performs the teaching strategy to stimulate students’ taking part in learning science lesson.

**Table 5. Teacher’s strategy recorded by using Classroom Observation Checklist**

Stages of 3E LC and the POE strategy	Teacher Behaviors: <i>What Teacher Should Do..</i>	Recorded by	
		Observ 1	Observ 2
Exploration	1. present a stimulating experience that will engage the students’ interests about the topic “type of animal’s adaptations to their environment” using the POE.	√	√
<i>Prediction (P)</i>	2a. show students a picture of animal adaptation by displaying a poster containing the picture of. behavioral and structural adaptation.	√	√
	2b. encourage students predict what is type of animal adaptation on the picture	√	√
<i>Observation (O)</i>	3a. inform students to watch the short film of documentation about type of animal adaptations.	√	√
	3b. guide student to discuss what they see on the film and record their observation on notebook.	√	x
<i>Explanation (E)</i>	4. foster students group to discuss some of their observations from watching the film.	√	√
Explanation	5a. encourage one of student group voluntarily to share their discussion in front of the class;	√	√
	5b. ask for clarification or justification about student ideas on the presentation.	√	√
	5c. explain definition, new words, and explanation for the technical terms and definitions; adaptation, structural adaptation (camouflage, mimicry); behavioral adaptation (hibernation, migration)	√	√
Expansion/ Application	6a. provide opportunities for students to use new terms and definitions.	√	√
	6b. document student ability to use concept outside of original context.		
The percentage agreement of two inter raters (observers)		91 %	

Note: √ is indicated as “observable (=1)”; x indicated as “not observable (= 0)”.

#### IV. CONCLUSION

Through encouraging students to engage in the class, they learned more. Accordingly, it is vital that teachers create the right classroom environment for promoting student's engagement for learning such as raising student interest; developing an interaction with students; challenging students to participate and take chances. These all affect how much their students engage and learn.

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