

# The Quality of Level of Inquiry-Based Lesson Design Through Lesson Study

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**Abstract**—The purpose of this research is to investigate the quality of Level of Inquiry (LoI)-based lesson design. This was developed and implemented on science learning in Junior High School through lesson study. The Level of Inquiry learning model is a further development of inquiry learning with the purpose that teachers and students are more directed in conducting inquiry learning, the higher level in LoI, the less role of teacher and the students are more dominant in the learning process. The research method used was qualitative descriptive. The data collected is a lesson design developed by a science teacher who is used to following lesson study activities and was analyzed using the rubric. Based on the assessment of lesson design rubric with 19 criteria in four domains (instruction, organization, assessment, and learning of inquiry), the results reveal that the strength aspects of learning were learning objectives, opening instructions, and instructions that differentiate groups and individuals. In organizational aspects such as defining rules, setting classrooms, group composition is also a clear. The weakness lies in the teacher developing LoI learning, especially at the stage of manipulation and verification. This finding helps teachers to gain insight into the characteristics of the level of inquiry-based lesson design.

**Keywords:** *level of inquiry, lesson design, lesson study*

## I. INTRODUCTION

Indonesia is one of the countries participating in the Program for International Student Assessment (PISA). Based on the results of the 2015 PISA study, Indonesia ranks 62nd with the science score is 403 [1]. The results of the PISA study are in accordance with the ability to apply science, science competence, science application context, and the scientific literacy of junior high school students in Indonesia. Those are in the low category. The main factor of this low yield is caused by the learning process, that only for transferring knowledge from teacher to students. Students are not given the opportunity

to build their knowledge independently and they are not introduced to the actual environment. Students considered natural science to be very abstract and not applicable in their lives.

Natural Science is not only helping find out about nature that consists of facts, concepts, or principles, but also learn about a process of discovery knowledge. Natural Science is needed in daily life to find human needs through problem-solving process [2]. As constructivism paradigm, by the learning, students must develop their knowledge by their own. Constructivism theory gives freedom to students who want to learn or find their knowledge with their ability and facilitated by others [3].

In this case, students take an important role in learning, while teachers must be flexible as needed by students in the process of considering their world. When teachers give examples or models for students, and at the times teachers create curiosity and ask students to make something new. At certain times teachers give students the freedom to argue and experiment on their own with their environment. Teachers are just encouraging and directing [4]. One of the lessons that emphasize discovery and building independent knowledge is inquiry learning. Besides, one of the science learning models proposed by the Indonesia's government based on the 2013 curriculum is inquiry-based learning.

The teacher's role in learning can be started from learning planning known as lesson plans or lesson designs. Lesson design is a learning design that describes learning activities, assessments, methods, and resources needed for learning. Education mostly adopts a planning model that is oriented towards models from the economy and national planning [5]. A rational planning method requires the teacher to set goals, formulate alternatives, predict results, and understand achieving those goals. This type of linear and rational thinking

forms the basis of the main planning models discussed in the current teacher education program and is considered a prototype for lesson plans [6]. When the teacher discusses, they engage in mental dialogue about teaching agreeing to their plans.

Based on the research which discusses two groups of teachers who use Lesson Study as the focus of professional development, it was found that the benefit of using lesson study is related to teacher intellectuals and collaborative work [7]. Teacher can collaborates with their colleagues, overcoming their challenges asking team members approve them, and criticizing their teaching practices.

Based on observations in one school in Bandung, the teacher's lesson design was developed by collaborating with other science teachers in lesson study activities. Every learning that is done turns out in science learning students are familiar with learning activities in the form of giving phenomena, demonstrations, experiments and group discussions. The learning process that developed by the teacher consists of discovery learning, interactive demonstrations, inquiry lessons, and inquiry labs. This is in line with the Level of Inquiry (LoI) process presented by Wenning. Wenning Stated six levels of inquiry, namely discovery learning, interactive demonstrations, inquiry lessons, inquiry labs, real-world applications, and hypothetical inquiry [8]. LoI learning is a further development of inquiry learning. The purpose of this learning is for teachers and students to be more focused on conducting inquiry learning because each stage teachers and students perform different roles. The higher of inquiry level used, the less the teacher's role in learning. In other words, students are increasingly dominant in learning. This is very good in learning natural sciences, where students are active in building their knowledge.

Based on the problems described above, the question problem in this study can be formulated in the form of questions as follows: "How is the Quality of Level of Inquiry (LoI)-based Lesson Design on Science Learning Using Rubric in Junior High Schools?". The purpose of this study is to analyze the quality of Level of Inquiry (LoI)-based Lesson design for junior high school students in science learning carried out for 4 cycles using the rubric. Teacher designs the inquiry-based lesson design in science learning. The focus of this study is to analyze the quality of lesson design using the adopted of lesson design assessment instruments.

## II. METHODS

### A. Research Design

The research method used was the descriptive qualitative method. The qualitative research is research that explores the quality of relationships, activities, situations, and material of an event [9]. This qualitative research focused on the characteristics and quality of inquiry-based lesson design developed in junior high school science learning, not a generalization for all junior high school science teachers.

### B. Participants and Research Sites

Participants in this study were science teachers in one school who taught in junior high school, Bandung. This study observed on the process for developing and implementing the lesson design that consists of 4 cycles. The selection of participants was based on the experience of lesson study activities that had been carried out by participants in the junior high school for several years, so that when this research was conducted participants did not feel disturbed by the activities of observers or researchers and continued to conduct learning activities naturally.

### C. Data Collection

The data collection phase was carried out with stages in lesson study activities, namely design, observation, reflection, and re-design. The lesson study stages were carried out for 4 cycles to see changes in the pattern of development and practice of inquiry-based design based on the level of each cycle so that the factors that influenced the development and implementation of the learning activities applied were analyzed.

The instrument used to explore the characteristics of inquiry-based level design lessons have been developed by the teacher through lesson study modification assessment rubrics for lesson plans with collaborative learning models according to Ilse Ruys [10] and LoI learning according to Wenning [8]. There have many criteria for analyze, as stated in table 1.

TABLE I. DESCRIPTION OF THE CRITERION FOR ANALYSIS LESSON DESIGN

Domain	Rubric criterion	Description of the criterion
<b>A. Instruction</b>	A.1 Lesson Objectives:	Does the teacher strive for lesson objectives in addition to content-related lesson objectives?
	A.2 Learning task/assignment:	Does the teacher use an adequate collaborative learning task that is adjusted to the developmental level of the students and the lesson objectives?
	A.3 Materials and resources:	Does the teacher use adequate materials and resources that are compatible with the lesson objectives and the type of LoI?
	A.4 Opening instruction:	Does the lesson plan contain adequate information for the opening instruction of the teacher?
	A.5 Teacher as a guide:	How will the teacher guide the collaborative learning process?
	A.6 Differentiated instruction:	How will the teacher deal with differences between students and/or groups during collaborative learning?
<b>B. Organization</b>	B.1 Classroom arrangement:	How will the teacher arrange the classroom, realizing possibilities for direct interaction between the students in their group?
	B.2 Rules and agreements:	How will the teacher manage the classroom by developing rules and agreements during collaborative work?
	B.3 Timing:	Does the teacher describe adequate timing for the lesson?
	B.4 Group composition:	How will the teacher compose groups that promote efficient and effective LOI?

Table 1. Cont.

<b>C. Evaluation</b>	C.1 Monitoring group processes	How will the teacher observe the approach and progress in individual students and/or groups?
	C.2 Evaluating the learning process:	How will the teacher assess the group process?
	C.3 Evaluation of the learning product/outcome:	How will the teachers assess the learning/ product/ outcome?
<b>D. Level of Inquiry (LoI) Learning</b>	D.1 Steps of Learning LOI	Does the teacher have a clear view of the LOI learning steps he will take in his lesson?
	D.2 Observation:	Students observe a phenomenon that engages their interest and elicits their response. Students describe in detail what they are seeing. They talk about analogies and other examples of the phenomenon. A leading question is established that is worthy of investigating.
	D.3 Manipulation	Students suggest and debate ideas that might be investigated and develop approaches that might be used to study the phenomenon. They make plans for collecting qualitative and quantitative data and then execute those plans.
	D.4 Generalization	Students construct new principles or laws for phenomena as needed. Students provide a plausible explanation of the phenomenon.
	D.5 Verification:	Students make predictions and conduct testing using the general law derived from the previous stage.
	D.6 Application:	Students set forth their independently derived and agreed-upon conclusions. The conclusions are then applied to additional situations as warranted.

**D. Research Procedure**

The research to analyze the quality of Level of Inquiry (LoI)-based Lesson design for junior high school students in science learning carried out for 4 cycles using the rubric and its implementing. The research is divided into 4 stages, the preparation, data collection, data analysis and research results stage. The researcher prepares research in terms of literature review and preparation of research instruments to be carried out in the preparation stage. Data collection stage is the stages that exist in lesson study, namely the planning of learning (design), implementation of learning (observation), and reflection of learning (reflection). The next stage is the data analysis consisting of transcript activities starting from the design, observation, reflection and re-design stages of each cycle and continued with data analysis using Transcript Based Lesson Analysis (TBLA).

**III. RESULTS AND DISCUSSION**

TABLE II. CHARACTERISTICS OF EACH LESSON DESIGN

Lesson Design	Learning of LoI	Lesson Objectives	Essential Subject Matter
Lesson Design 1 (LD1)	Level 2 (interactive demonstration)	Through discussion and demonstration, students can find out the resolution and magnitude of vibration.	Definition of vibration and magnitude on vibration (Amplitude, Period, and Frequency).
Lesson Design 2 (LD2)	Level 4 (inquiry laboratory)	Through experiments, students can identify factors that influence the period and determine the relationship between period and frequency.	Factors that affect vibration frequency and the relationship between period and frequency of vibration.
Lesson Design 3 (LD3)	Level 2 (interactive demonstration)	Through discussion and demonstration, students can find out the types and magnitudes of waves.	Wave definition, delivered energy and type of wave-based on intermediate medium, transversal and longitudinal waves (definition, understanding 1 wave, amplitude), wave magnitude (period, frequency and wave velocity)
Lesson Design 4 (LD4)	Level 4 (inquiry laboratory)	Through discussion and experiment, students can find out the factors that influence sound waves in strings.	Sound conditions are heard, sound waves based on frequency, weak sound strength (amplitude), high low sound (frequency), factors that affect the frequency of the strings, tone and siph, timbre, resonance.

The results of analyzing 4 lesson plans with assessment rubrics in the quality of lesson design (Table 2) focused on 4 domains, there are (a) instruction, (b) organization, (c) assessment [10] and (d) LoI Learning [7]. Figure 1 provides an overview of the results for the assessment in various criteria. Criteria are seen as a 'strength' when having the highest percentage, while a 'weakness' is defined when having the lowest percentage. The criteria were measured for each.

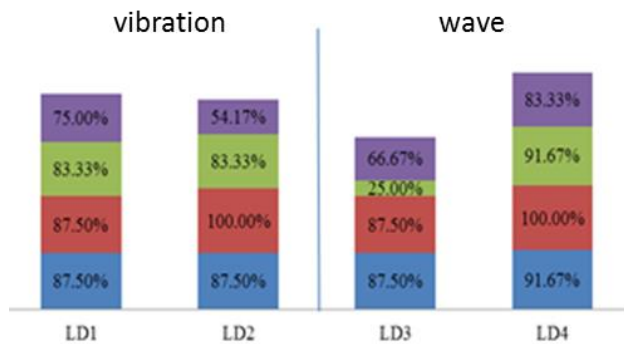


Fig. 1. Result of Assessment of Lesson Design (LD1-4) for Vibration and Wave Material. The color of each bar shows 4 different criteria (purple=instruction; green=organization; red =assessment and blue LoI Learning).

**A. Strengths in Level of Inquiry (LoI)-based Lesson Design**

The most striking strength in teacher’s lesson design is generally related to instruction and organizing. Instruction and organization have high percentage of 87.50% on the first learning cycle. The highest point of assessment for the instruction section comes from the learning objectives, the opening instructions for learning, the differentiating instructions between groups and individuals. While the highest assessment points for the organizing section are derived from the class organization, learning rules and agreements, and group composition. In second lesson design, organizing has high percentage (100%). It is means all criteria for organizing get the highest point. While the third lesson design, instruction has high percentage (91.67%). The highest points of assessment for the instruction section come from learning objectives, opening instructions for learning, teaching resources and materials, and differentiating instructions between groups and individuals. For the fourth lesson design, organizing has high percentage (100%). It is means all criteria for organizing get the highest point.

In this case, it seems that teacher able to produce a good basis for learning in terms of providing instruction and organizing learning because the teacher is trained and accustomed to developing design lessons according to these criteria through lesson study activity collaboratively.

**B. Weaknesses in Level of Inquiry (LoI)-based Lesson Design**

The most striking weakness in teacher lesson design is generally related to LoI learning. The first lesson design has a percentage of 62.50%. The lowest point for this section comes from the quality of designing LoI learning in the stages of manipulation, verification, and application. The second lesson design has a percentage of 54.17%. The lowest point for this section comes from the quality of designing LoI learning in the stages of observation, manipulation, and verification. While the third lesson design has a percentage of 66.67%. The lowest point for this section comes from the quality of designing LoI learning in the stages of manipulation and verification. For the fourth lesson, the design has a percentage of 83.33%. The lowest point for this section comes from the quality of

designing LoI learning at the stages of observation, manipulation, and application.

In this case, it seems that teacher find the difficulty in developing LoI learning especially for the manipulation stage because the teacher has not been trained and is accustomed to developing design lessons according to LoI learning. LoI learning is new methods that developing and implementing in that school.

**C. Strengths and Weaknesses in Level of Inquiry (LoI)-based Lesson Design**

Regarding the criteria "related to instruction", the findings show that the purpose of learning, opening instructions, and instructions that distinguish between groups and individuals. It seems that experienced teachers develop according to curriculum objectives and consider the learning outcomes of each meeting. Lesson design must consist of four important elements: the purpose of education, the classroom experience to achieve this goal, the setting of effective experiences, and determining whether that goal is achieved [11].

Many new teachers have difficulty integrating subject topics, understanding concepts or tasks embedded in curriculum material, and juggling conflicting goals when there is uncertainty about how to achieve a lot, the desired results [12]. As a result, there is often a gap between goals, objectives, and targets on the one hand and the teaching and learning process on the other. The lesson plan should not be seen as a blueprint for action, but also should be a record of the interaction. Such definitions will help students see deviations from the lesson plan as a positive action rather than evidence of failure [13].

Furthermore, the teacher’s point must be evaluated on organizational aspects, such as defining rules, the setting classrooms, group composition, and time. In this case, the teacher must remind students about aspects of class management and the effectiveness of the learning process. With the assessment of rubric criteria, it is clear that the teacher focuses on the designing of rules, arrangement of the classroom, the planned group composition for the effectiveness of students in learning. Most monitoring and timing are not in the lesson plan. This shows the teacher's objective perspective on time allocation.

Concerning the assessment criteria, the teacher mainly focuses on learning products mostly at the end of the lesson. Monitoring of learning is largely not in the lesson design. Whereas concerning LoI learning some design lessons are still low in terms of manipulation and verification. Teachers in planning learning still dominate in the stages of manipulation and verification. Teacher still lacks trust if students in manipulation activities such as giving opportunities to students in giving ideas that might be investigated, developing approaches that can be used to study phenomena, making plans to collect qualitative and quantitative data. Even though the teacher in this study was painted with a theoretical and empirical background from the LoI, it seems that it taught them about the implementation of LoI rather than the whole to

achieve an adequate quality of lesson design. Based on this description, it is suggested for teachers to implement the LoI learning for others material or subject lessons.

Lesson design describes how learning will be revealed, this describes learning activities, assessment methods and the resources needed to teach lessons [14]. The current thinking is that lesson design is a linear path that begins with the purpose of teaching. Planning is natural or naturalistic if it is started with activities and ideas flow from them before setting goals. By this way, lesson plans are considered responsive to the needs of children and teachers can pursue goals that emerge rather than predetermined [15].

Therefore, it is important to develop teacher competencies in lesson design to make them more independent of textbooks. Constructing the effective planning is an important element of good teaching and promoting student achievement [16]. The Lesson Study approach is a way for teachers to engage in professional development that leads to activities that promote change in learning. The study has the benefit of drawing teachers' attention to student learning when they think of their instructional actions. The further advantage of Lesson Study is that it allows the teacher to observe students during planned lesson teaching. When the teacher observes students, they begin to see teaching from students' point of view: This new perspective can change the concept of teaching that is rooted and produces better student learning.

#### IV. CONCLUSION

By this study, it was revealed that the teacher has competence in developing learning plans in the aspect of giving instructions and classroom organization. In terms of instructions, namely learning objectives, opening instructions, and instructions that differentiate between groups and individuals as well as organizational aspects, namely defining rules, setting classrooms, group composition is also a clear force. The weakness lies in the teacher developing LoI learning, namely at the stage of manipulation and verification. It seems to be a challenge for teachers to develop LoI-based learning planning. To build the students' knowledge, teachers need to design appropriate lesson designs to facilitate students in learning so that maximum outcomes.

#### ACKNOWLEDGMENT

The authors are grateful to the principal of Junior High School 1 BPI Bandung and the model teacher who has facilitated and provided new knowledge during this research, and immensely grateful to teacher model for her lesson design and learning.

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