The analysis of teacher’s ability in create lesson plans and student worksheet

S Haryani*, S Wardani, K I Supardi and A T Prasetya
Chemistry Department, Universitas Negeri Semarang, Semarang, Indonesia

*Corresponding author: haryanimail@gmail.com

Abstract. The purpose of this study was to analyze the ability of teachers in designing the lesson plan and student worksheet based on learning models of Curriculum 2013. A total of 8 people as subjects in this qualitative descriptive research. The ability to design lesson plans and student’s worksheet which prepared by subjects was analyzed using a particular assessment rubric. The performance of lesson plans preparation was generally weak in terms of writing preliminary and learning activities. The ability of give apperception in terms of connecting between the pre-requisite and the material to be studied was less attention. In the case of the writing of learning activities in student’s worksheet, 4 out of 8 subjects choosed discovery learning. The stimulus provided in worksheet still lacks opportunities for students to identify problems. PBL and PJBL models were selected by the rest of the subjects. The results were also not appropriate for writing for a student-oriented phase on issues for PBL and fundamental questions for PJBL. Another weakness was the ability to give students opportunities to construct their own knowledge through connecting observation data, video observation, or discussion activities. Some things that have been considered were the integration of character education development and literacy reading. Higher-order thinking (HOTs) still needs to be improved. In addition, the ability to understand the vastness and depth of the material, and learning strategies need to be improved better so that students were able to construct their knowledge.

1. Introduction
The learning process in the classroom was a manifestation of the implementation of process standards, and the teacher was a central agent in realizing a quality learning process. Efforts to develop teachers professionally to understand their duties well have been carried out. However, the reality in the field showed that the quality of the learning process in the classroom was still a very important issue to improve. Findings in the field from several times activities starting from 2010-2017 show that some teachers were in desperate need of mentoring in planning student-centered learning and could be directly applied to students. Preparation of lesson plan and student worksheet as a guided to conduct investigation and problem solving activities then students were able to construct their own knowledge, so far we have chosen to be carried out in this activity [1,2]. All forms of collaboration with teachers both group (MGMP) and with certain teachers, were intended to improve the chemistry teacher's professionalism so that the quality of the learning process in the classroom also increases. The fundamental contribution to the MGMP teacher group is the increasing number of teachers in terms of the quality of professionalism in presenting chemistry learning to students through learning models that were in accordance with goverment ruler [3].
The format and content of lesson plan preparation has repeatedly changed, especially in learning activities. Meanwhile the demands for writing learning activities in the lesson plan [4] in addition to having to meet constructivist aspects also integrate high-level character and thinking. On the other hand, based on the latest findings related to the preparation of teacher lesson plans and student worksheet, several prominent weaknesses were: 1) difficulty in writing down problems for various models of PBL and PjBL, 2) not considering prerequisite material, 3) depth of material, and 4) lack of attention to linkages between data observation and data analysis [5].

Preparation of lesson plan and supported by student worksheet teaching materials as a guide to conduct discussion activities, understanding concepts, investigating, reducing formulas, and solving problems were a strongly vehicle suspected of being able to develop higher-order thinking skills [6]. Through the preparation of this student worksheet, teachers did not only write trial procedures or questions, but are required to select and sort the material, think of an equality found by their students, design so that students are able to link observational data with discussion, and think of compatibility with indicators of achievement of competence. With good content mastery, the teacher could also know or recognize the misconceptions that occur in students, can choose which content was most important to be taught and will not transfer misconceptions to students [7]. If the ability to design this learning device can be owned by prospective teachers/ university students even lecturers, it would be increase the constructivist ability and the ability of Pedagogical Content Knowledge (PCK) as expected by the IQF for education can also be achieved.

Based on the arguments that have been described, it is important to look more deeply at the competence of the teacher in designing learning plans that are able to integrate various aspects such as high-level thinking and the development of character education. Learning planning that can oversee the learning process up to class and directly applied to students is lesson plan and student worksheet (Haryani, et al, 2017). This study is aimed at analyzing how teachers write preliminary activities, integrating various models into learning activities, as well as the depth and demotion of the material.

2. Methods
This descriptive study was carried out by gathering information on the teacher's ability to construct constructivist lesson plan and student worksheet. A total of 8 teachers involved have different backgrounds in terms of education, years of service and experience teaching chemistry subject matter. Six of the 8 teachers currently involved are still postgraduate students of Chemistry Education Study Program, and 4 of 8 teachers have collaborated in mentoring with the research team in MGMP activities. Mentoring has been carried out starting from designing learning activities based on learning models which are then outlined in lesson plan and worksheet.

The research was conducted by asking them to collect a minimum of 2 lesson plans and 1 homemade worksheet. The ability to design lesson plans and worksheet compiled by the research subjects was measured using the assessment rubric that had been prepared. The assessment rubric was elaborated from Permendikbud 022 in 2016 and an assessment sheet from the PPL UNNES Guidebook. In addition, interviews were also conducted to explore students' knowledge regarding the deepening of the material that was built at each step of the learning syntax. Furthermore, the combination of the results of measuring the ability to design lesson plans and worksheets and the results of interviews were analyzed in depth to be described qualitatively.

3. Results and Discussion
This research was a preliminary study to obtain an overview of the ability of the teachers in designing lesson plan. The research instrument to collect the data of this study used the documentation method of the drafted lesson plan with an assessment rubric that was used to collect data related to the preparation of the lesson plan. In addition, interviews were also conducted to find information on the drafted lesson plan. The following will be discussed the discussion of the results of the drafting of the lesson plan and student worksheet.
3.1. Preparation of Lesson Plan
3.1.1. Formulating Competence Achievement Indicators (CAI)

Lesson plans were a plan of face-to-face learning activities for one Basic Competency (BC) that was carried out in one meeting or more. It was developed from the syllabus to direct the learning activities of students in an effort to achieve BC. After writing the identity, Core Competency (CC) and BC, the problems that began to emerge were formulating the Competency Achievement Indicator (CAI). Three of the 8 teachers: (1) have not paid attention to the operational verb, (2) have not accommodated BC needs, and (3) have not connected the BC from CC 3 and BC from CC 4. Based on the interview, the teachers did not know that BC from CC 3 and CC 4 were inseparable pairs in learning. In addition, they also did not know the use of operational verbs from Anderson taxonomy for aspects of knowledge, and the use of CAI skills with operational verbs that describe the expected skills achievement in the BC [8,9].

The CAI formulation was very important because it was accommodating BC and showed the order of material. For example in the Basic Laws of Chemistry that underlie chemical calculations, however, when the discussion of Proust's law involved both atomic relative mass and molecule relative mass concept. Another example was in thermochemistry material, when discussing exothermic and endothermic reactions, the teacher mentions enthalpy changes even though students do not know the concept of enthalpy (which previously had not been raised in the CAI about the definition of enthalpy). The order and depth of material that was not suitable could be the cause of misconceptions. Misconceptions often occur in basic chemical laws, especially in the mole concept and stoichiometry. Moles are an abstract idea - we cannot “see” Avogadro’s number of particles, so the best we can do is to present an idea of how big this is. To use the mole meaningfully requires mathematical skills, which present an additional challenge [10,11].

3.1.2. The Preliminary Activities

The preliminary activities besides preparing participants inpsychically and physically to follow the learning process, also must motivate, provide apperception, tell learning objectives and material coverage. Based on the lesson plan document prepared by the teachers, all of them have written down the learning objectives and material coverage [12]. Six out of 8 teachers wrote apperception all similar, only gave the signs what should be written in the lesson plan (general apperception), one teacher was more general, and only 1 teacher wrote the scenario well (specific apperception). One participant wrote: "Teacher give apprenticeship to students, before entering the material" Here are examples of apperceptions written by six teachers who turned out to be joint products of the MGMP, and 1 teacher.

**General Apperception**:
- Linking the material / theme / learning activities that will be carried out with the experience of the students with the previous material / theme / activity
- Remind the prerequisite material by asking.
- Ask questions that are related to the lesson that will be carried out.

**Specific Apperception**:
- Students are given stimuli by asking questions about the previous material as reminders of students to relate it to the material to be taught. For example,
  a. have you studied the material you have assigned?
  b. Try, mom wants to know your memories about the previous material, hydrocarbons.
  c. What elements make up hydrocarbon compounds?
  d. What substances are constituents are hydrocarbon compounds that we usually encounter around us?
  e. For example, what gasoline is the constituent of hydrocarbons, what gasoline comes from?

Furthermore, for motivational activities it was also similar to apperception activities, some wrote signs, more detailed scenarios were written, but 1 teacher did not write at all. This research was
accordance with the results of Haryani, et al. [5,12]. This motivating activity minimally provides an overview of the benefits of learning the lessons to be learned in daily life [3,13]. The following is a more detailed example:

**Motivation**

Learners are given motivation to focus attention, by guiding them to find out material about petroleum. For example:

a. What is in your mind when you hear the gas station?

b. When you go to the gas station what do you buy?

c. Where is the fuel used for the vehicle?

d. When you are on the highway and when you observe the highway what materials are used to make the highway?

e. Where did the material come from?

f. When the lights are off, what objects are used to replace lighting?

g. What is the candle coming from?

**3.1.3. Core Activities**

Core activities are designed using learning models, learning media, and learning resources that are tailored to the characteristics of students and subjects. In addition, it also integrates the development of character education, high-level thinking (HOTs), literacy, and religious character [14]. All Teachers have written the steps in each stage of learning according to the model chosen. Six teachers chose themodel *Discovery Learning (DL)*, 1 PBL teacher and 1 more PjBL teacher.

Phase 1 of DL was the giving stimulus intended which it stimulate students to identify problems that must be solved, ask questions and desires to investigate themselves. Teachers can start learning activities by asking questions, showing phenomena, and other learning activities that lead to problem solving preparation [15]. Six participant who chooses DL had not written in detail the activities that must be carried out by students, it is still general, and this of course will complicate the next phase of the problem statement. Based on the results of the interviews, the teachers found it difficult because they were not familiar and there were not many examples. For example of writing stimulus as follows:

Students are given motivation or stimulation to focus attention on the topic of definition and measuring the rate of reaction by displaying a video or giving an example of understanding the rate of reaction.

Review literature on systems and the environment to train sincerity, thoroughness, seek information.

Furthermore, for the 2 other teachers, they have clearly implemented PBL or PjBL learning steps, by integrating character, and high-level thinking in core activities. However, as phase 1 in phase 1 writing DL is also still very common. For the provision of problems in PBL it still lacks the contextual, rules *open ended*, and unstructured. Likewise, PjBL does not accommodate the problem as a whole. The following is an example for both problems:

Questions that can assign students in carrying out an activity related to the project that will be made by students.

The teacher direct one of the students from each group to come to the front of the class to take a discussion sheet containing the task of developing the redox concept

The teacher presents a problem by displaying problems about the phenomenon of insect bites and sour taste in meatball sauce

- Can formaldehyde be used for food preservatives? Why?
- Do you know how to find food containing formalin?
The teacher builds a dialogue with students by asking questions about using nitrogen and oxygen everywhere?

3.1.4. Closing Activities
In the closing activities, lesson plan contains follow-up activities in the form of assignments, both individual and group assignments; and inform the planned learning activities for the next meeting generally. Other activities that have not been written are to provide feedback on the learning process and results, and to reflect to evaluate the entire set of learning activities and the results obtained to further find out the direct and indirect benefits of the learning outcomes that have taken place [16].

3.2. Student Worksheet Analysis
All material content (topics and sub-topics) subjects derived from skills ability must encourage students to carry out the observation process to creation (scientific approach) [17]. To realize these skills, it is necessary to conduct research-based learning (discovery / inquiry learning) and problem based learning (PBL), as well as those that produce work based on problem solving (project based learning). Furthermore, student worksheet analysis was emphasized in realizing lesson plan, especially core activities that using the selected learning model. Six teachers who write the core activities were still very common. In the preparation of the worksheet, there were some appropriate with the sintaks of the learning model but also there were not appropriate. The teacher who chooses PBL was appropriate, but the teacher who chooses PjBL was still not appropriate. Overall the results of the preparation of the student worksheet had shown the steps of learning according to the model, but the content still needs to be improved. The following description was focused on phases 1 and 2, because the next step depends on phase 1 and 2 for all models selected.

3.2.1. Worksheet based on Discovery Learning
One of worksheet based on DL was good. In phase 1 shows the formation of metal bonds previously informed of the formation of other bonds. Based on the images displayed, there will be a lot of questions from students, which must be written in phase 2. Through writing the appropriate phase 1 and 2, phase 3 and so on will be more focused [18,19]. Unlike the teacher who is writing common core activities in lesson plan for stimulation (phase 1) and problem identification (phase 2), it was not appropriate. Then the data collection becomes less directed (the student has no idea what to do in the next step). The example of common phase 1 and 2 could be seen below:

Students are asked to look at orbital diagrams and quantum numbers, then pay attention to the teacher's explanation.

Students are given the opportunity to ask questions after getting a teacher's explanation

3.2.2. Analysis of PBL worksheet
Characteristic in PBL model was orient students on problems (phase 1) [20]. The problems delivery in PBL still lacks rules such as contextual, open ended and unstructured. The first example of findings from the lesson plan is compiled: contextual problems but not related to BC, the problem was very structured, and it needs a lot of practice to make open ended problem. Instead the second example, has met the problem of the three recommended aspects. The following examples in phase 2 were written below.

In Semarang high school chemistry laboratory there are various types of salt crystals. Are the salts the same as the salt your mother used to cook? Are these salts also salty like those in our kitchen? Beware, do not ever try to taste the salts in the laboratory. Why?

Kitchen salt used for cooking is easily dissolved in water. Some salt in the laboratory is salt that is difficult to dissolve in water. Any salt that is difficult to dissolve in water.
Pay attention to the following picture. Have you ever eaten ice ice? Do you know that rotary ice is made without using a cooling machine? If so, how do you freeze it?

Phase 2 in PBL was orient students in learning. It was intended to help students define and organize learning tasks related to the problem. This phase was an important phase for directing students what must be known and what was important to learn. In this phase teachers were required to make steering questions that accordance with competency achievement indicators and relate to problems in phase 1 [20]. Based on 2 examples in phase 1 above, the first teacher writes for the second phase by asking students to identify the pH of the salts that make up the cation and the anions are different. While in phase 1 salt is difficult to dissolve. Thus between phases 1 and 2 are less content related. On the contrary, the second example is more focused by giving questions to be answered in phase 3. The weak facts of writing phases 1 and 2 in PBL wereless in making questions related to CAI which it related to problems in phase 1. Problems linking prerequisite material, sequence of material, the depth of material were important to be mastered so that the difficulty in making questions that lead to constructivists could be minimized [21].

3.2.3. Analysis of PjBL LKPD
Project Based Learning is designed to be used on complex problems that students need to investigate and understand [22]. Learning begins with essential questions, which are questions that can assign students to do an activity. When the question was answered, students can directly see the main elements as well as various principles in a discipline that they are studying. PjBL is an in-depth investigation of a real-world topic, this will be valuable for the attention and effort of students. As in the DL and PBL models, for PjBL, the syntax will also be described in phases 1 and 2.

**Fundamental Questions.** Teachers are very difficult to make basic questions in phase 1, which includes all material or all BC, which leads to project creation, and is contextual [23]. Through these essential basic questions can assign students in carrying out an activity. However, most narrated things that were contextual but not yet comprehensively linked to the material. Here are 2 examples that are suitable for the first example, and the second is not appropriate.

First Example (appropriate for PjBL):
Coconut water has a slightly sour and slightly sweet taste. This shows the presence of sugar / carbohydrate and acidic compounds. Fermentation of coconut water produces vinegar. How to make vinegar acid from coconut water and how to make use of its diversification products in chemistry learning? how to measure the pH, calculate the concentration of the solution, and the amount of vinegar in market? What indicators are appropriate for pH identification and diversification result vinegar titration? No less important is how the diversification of coconut water waste in chemistry learning can increase noble character values?

Second example (less appropriate for PjBL):
Preservatives are useful for preserving the product so that it does not change shape and taste? Besides that there is a theory that acidity regulators also play an important role in making packaged juices because with the acidity regulator the juice pH is maintained. Acidity regulating substances are referred to as buffer solutions / buffer solutions.

**Project Planning.** Phase 2 of the PjBL model is a key phase to direct students to work on projects related to the material. The difficulty experienced by the teacher was to give the task of designing projects but also related to the material. Before the project planning stage, students have first mastered the concept, through the provision of projects / tasks that are intended to enable students to construct their knowledge. After completing facilitating students to extract their knowledge, new students start designing projects. For the example of the first fundamental question, students already have a picture of the relevance of the material to what will be done. On the other hand, for the second example, it is only limited to the definition of buffer and pH, the mixture component and the mechanism of buffer
work have not been accommodated. As an example to complete the fundamental question added to the sentence:

In many markets we find packaging products that have a grace period or exp. Date. What really makes the product last?

According to Loughran (2011) the teacher's knowledge in choosing the right model and strategy and media to teach concepts with certain competency achievement indicators is an important aspect in Pedagogical Content Knowledge (PCK). Furthermore Loughran stated that PCK was a knowledge that requires special expertise for a teacher. This knowledge was formed through a combination of profound content mastery and good pedagogical knowledge so as to create an effective learning by considering various things. Mastery of profound content and good knowledge of pedagogy so as to create an effective learning were closely related to designing constructivist worksheet based on learning models. In connection with the concept there are 3 things, namely important concepts, breadth and depth, and identification of misconceptions. Misconceptions that often occur due to students' initial knowledge, teacher teaching strategies, textbooks, and their relation to other concepts such as mathematics and physics [5].

The findings of this study are allegedly in line with states that the higher the conceptual understanding of teacher students, the higher the pedagogical abilities possessed [24]. Nevertheless, there are still teachers who have good pedagogic abilities because of other factors, namely communication skills, and this is in accordance with Goolamhossen's opinion [15]. In addition, Loughran stated that although understanding some of the content well, but to integrate it with teacher's pedagogy requires other sciences not only subject matter, the knowledge gained through experience [12]. All statements related to a Teacher's PCK are also contained in Minister of Education Regulation No. 16 of 2007 concerning the standards of academic qualifications and teacher competencies.

4. Conclusion
The preparation of the lesson plan still needs to be improved was in the preliminary activities and core activities. Apperception ability and motivation in preliminary activities, especially in terms of linking between prerequisite material and material to be studied were still very common, as well as for motivation not to write well the benefits of learning material. In the case of writing learning activities that were also displayed in worksheet, 4 out of 8 subjects chose discovery learning. In general, writing a stimulus was still not giving students the opportunity to identify problems. The PBL and PPjBL models were chosen by 4 subjects. The biggest difficulty in phase one orientates students to problems for PBL and fundamental questions for PPjBL. Another weakness that arises were the ability to provide opportunities for students to build their own knowledge through connecting observational data, video observations, or discussion activities. Some of the things that have been noted are the integration of character development and reading literacy. Higher level thinking skills (HOTs) still need to be improved.

References
[1] Van Wyk G 2013 The professional Development of Live Sciences Teacher’s PCK and Profile of Implementation Concerning the Teaching of within a Community of Practic. (University of Johannesburg. Dissertation)
[2] Adadan E and Oner D 2014 Res. Sci. Educ.44(6) 829
[3] Peraturan Menteri Pendidikan dan Kebudayaan Nomor 22 Tahun 2016 Tentang Standar Proses Pendidikan Dasar dan Menengah.
[4] Permendikbud Nomor 49 Tahun 2014 Tentang Standar Nasional Perguruan Tinggi
[5] Haryani S, Wardani Sand Prasetya AT2016Pengembangan Program Pendampingan Pedagogical Content Knowledge (PCK) Guru Kimia Melalui Lesson Study Berbasis MGMP.(Penelitian Hibah bersaing LP2M Unnes)
[6] Goodyear V and Dudley D 2015 Quest. 67(3) 274
[7] Treagust D F 2016 High school students understanding of acid-base concepts: an ongoing challenge for teachers, IJSE(1), 9–27. https://doi.org/10.12973/ijse.2015.284a
[8] Hsu Y S, Paola I, Hsiao C S and Allyson H 2016 Int. J. Sci. Math. Educ. 14 243
[9] Lozada M V 2015 Int. J. Sci. Technoledge. 3(4) 63
[10] Perez JB 2017 Asian J. Educ. e-Learn. 5(1) 1
[11] Salim S 2017 Int. J. Sci. Matematics Educ. 15(5) 797
[12] Baser D 2016 Comput. Assist. Lang. Learn. 29 (4) 749
[13] Özcan Z Ç 2016 Int. J. Math. Educ. Sci. Technol. 47(3) 408
[14] Baheri S 2016 New Educ. Rev. 46(4) 29
[15] Goolamhossen F 2013 Int. Conf. Commun. media Technol. Des 02-04 May 2013. Farmagusta – North Cyprus.
[16] Janssen N 2016 J. Comput. Assist. Learn. 32(5) 456
[17] Ginger V 2015 J. Chem. Educ 93(3) 413
[18] Akanmu M and Fajemidagba A 2013 J. Educ. Pract. 4(12)
[19] Tompo B 2016 Int. J. Enviromental Sci. Educ. 11(12) 5676
[20] Ananda P Mand Azizah U 2016 Unnesa J. Chem. Educ. 5(2) 392
[21] Malahayati EN, Corebima AD, and Zubaidah S 2015 Jurnal Pendidikan Sains 3(4) 178
[22] Ling CC 2016 Int. J. Educ. Technol. 6(9) 709
[23] Boss S and Krauss J 2013 Thinking Through Project-Based Learning Guiding Deeper Inquiry. United States of America(SAGE Publications)
[24] From J 2017 Can. Cent. Sci. Educ. 7(2) 43