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PROFILE OF PROSPECTIVE CHEMISTRY TEACHERS ABILITY IN DEVELOPING LEARNING TOOLS ACCORDING TO STANDARD PROCESS

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ABSTRACT

Process standards can be interpreted as a certain measure that becomes the basis for assessing or determining the implementation of teaching learning activity to achieve the competences. In the educational unit, educator has to develop learning tools, such as the Lesson Plan (*Rencana Pelaksanaan Pembelajaran/RPP*). Therefore, this research was conducted to describe the profile ability of prospective chemistry teachers in developing lesson plan in accordance with the criteria of the *RPP* component in the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 22 of 2016 about Primary and Secondary Education Standard Process. The research method used was descriptive with a quantitative approach, about 10 chemistry education students in the 6th semester who were determined by purposive sampling was participated as a research subject. Research data was obtained through the RPP assessment rubric that consists of 8 indicators with a score range 1 to 4. The technique of data analysis was percentage analyses, which were converted into the interval category criteria. Based on the analysis, it is known that profile of prospective chemistry teacher in developing lesson plans is in the good ability category. However, there are several components of the lesson plan that need to be improved, so that the results can be used as a reflection and evaluation of related subject lecture activities.

Keywords: Chemistry education, lesson plan, standard process.

INTRODUCTION

Teachers as professional educators have a strategic role to realize the implementation of learning in accordance with the principles of professionalism to realizing the goals of national education. *Undang-undang*

Republik Indonesia Number 14 of 2005 concerning teachers and lecturers states four competencies that need to be possessed by teachers, namely; pedagogical, professional, social, and personality competencies. Teacher as a professional teacher, should have sufficient personal development capacity to carry out students in learning activities and actualize, as stated in Government Regulation Number 19 of 2005. Related to professional competence, teachers' pedagogical competence becomes one of the urgencies in teaching and learning activities. Through these competencies, teacher be able to carry out an effective learning process and affects students' learning outcomes (Sahin-Taskin, 2017).

Planning, implementation, and assessing the learning process must be prepared by each education unit to improve the efficiency and effectiveness of competency achievement, as stated in Regulation of the Minister of Education and Culture Number 22 of 2016. Based on this statement, teacher as an educator must to design a learning tool that supports teaching and learning activities, such as teaching materials or student books, student worksheets, lesson plans, learning media, and learning evaluation instruments. In this study, learning tools referred to the Lesson Plan (*RPP*); written steps about activities that represent the steps to be taken in class in 1 or more meetings, to prepare the learning activities until the assessment (Nesari & Heidari, 2014). Most of prospective chemistry teachers have the perception that the lesson plan is one of the complex learning tools (Sahin-Taskin, 2017). The lesson plan contributes to the management of teaching and learning activities to becomes effective (Maclennan, 2015). Lesson plan have a positive impact to help students' success. In addition, teachers could be manage the class through the time management of the teaching intervention. This is only possible with the design and implementation of a good lesson plan (Maclennan, 2015). Therefore, teachers need to be encouraged to be an open minded in developing effective, informative, and innovative lesson plan (Navaneedhan & Kamalanabhan, 2016).

Educational study programs that has an occupational profile as teacher candidates, have an important role in forming professional teachers to carry out the teaching and learning activities, and developing learning tools such as lesson plan. To develop the professional teacher candidates, it is require a process and experience to be professional through lecture activities. The developments of the lesson plan and experience process were trained according to the curriculum development and applicable regulations, because every change has a rationalization to keep up the demands of the times. A study before (Istiqomah, 2018) has shown the problems in the preparation of lesson plan by prospective teacher. Besides, being considered complex when viewed from the aspect of cognitive competence, the ability of prospective teacher in preparing lesson plans is still relatively low, even though this ability is needed by prospective teachers in school practice activities and become a professional teacher. This is indicates that the prospective teachers needs to accompanied by debriefing, training, or assignment of an ideal lesson plan preparation according to the standard process (Suciati & Astuti, 2016). In addition, prospective teacher also need to be trained to face the challenges of the global era; such as the need for human resources as a technological and open society (Oviyanti, 2013).

Based on the background above, this research was conducted to describe the profile ability of prospective chemistry teachers in developing lesson plan

accordance to the criteria of the lesson plan component in the Standard Process. The descriptive result about the profile of prospective teachers' ability in preparing lesson plans can be used as material for reflection and evaluation of related subject lecture activities.

METHOD

Research method in this study was descriptive with a quantitative approach. The quantitative approach was used to describe the profile of prospective chemistry teachers in developing the lesson plan. The variable referred in this study is the profile ability of prospective chemistry teachers in developing learning tools that are restricted as a lesson plan.

Ten chemistry education students in the 6th semester chosen purposively become subjects in this study. Total of 10 lesson plans documents were analyzed by two observers using the lesson plan assessment rubric that was adapted from the criteria of the lesson plan component in the Standards Process and microteaching assessment rubric. The rubric consists of 8 assessment indicators (Table 1). Each indicator is given a score range 1 to 4.

In addition to assessing and analyzing the lesson plans of chemistry teacher candidates, open questionnaires are also provided online. The item of questions have been validated by the expert, and approved to be used as an alternative interview to determine the perceptions and constraints of prospective chemistry teachers in developing lesson plans. Examples of parts of the lesson plan made by prospective chemistry teacher are present in Bahasa Indonesia to minimize the misinterpretation.

Table 1. Lesson Plan Assessment Rubric

No.	Aspect	Indicator
1	Formulation of indicator competency	a. Clarity of indicator competency formulation b. Conformity with learning competencies
2	Organization of learning materials	a. Suitability of teaching material towards: 1) Learning objectives 2) Students' characteristics b. Systematic of teaching material
3	Learning activity scenario	a. Suitability of learning strategy and methods towards: 1) Learning objectives 2) Students' characteristics 3) Learning material b. Suitability of the learning activity towards basic competences and time allocation.
4	Media and learning tools	Suitability of learning media and tools towards: a. Learning objectives b. Students' characteristics c. Learning material
5	References	Suitability of learning reference towards: a. Learning objectives b. Students' characteristics c. Learning material
6	Students' affective/psychomotor assessment	a. Appropriateness of assessment techniques towards learning objectives b. Clarity of the assessment procedure c. The completeness of the instrument
7	Students' cognitive assessment	a. Appropriateness of assessment techniques towards learning objectives b. Clarity of the assessment procedure c. The completeness of the instrument
8	Attachment	a. Learning materials b. Students' worksheet c. Instrument of students' affective/psychomotor

	assessment and rubrics
d.	Instrument of students' Cognitive assessment and rubrics

The acquisition of percentage data is qualified into the interval category criteria as shown in Table 2.

Table 2. Ability Category Qualification

No.	Interval (%)	Category
1	81-100	Excellent
2	61-80	Good
3	41-60	Moderate
4	21-40	Low
5	≤20	Very low

Table 2 was used to categorize the profile of prospective chemistry teachers ability in developing lesson plan. If the results of the assessment rubric from the two observers averaged X> 81% can be categorized as excellent; good if 61% < X ≤ 80%; moderate if 41% < X ≤ 60%; low if 21% < X ≤ 40% and very low when X ≤ 20% (Asyhari & Silvia, 2016). The score obtained was analyzed using a percentage analysis as follows.

$$\% = \frac{\text{total score obtained}}{\text{maximum number of scores}} x\ 100\%$$

RESULT AND DISCUSSION

The learning tool referred in this study is the lesson plan; written steps about activities that represent the steps to be taken in class in 1 or more meetings, to prepare the learning activities until the assessment. The 10 lesson plans document was developed by prospective chemistry teacher is a guided assignment in microteaching lecture. Through mentoring, the development of the profile ability of prospective chemistry teachers in preparing lesson plans can be seen. Two observers have participated in providing an assessment of the lesson plans developed by students, based on the instruments provided. The average score for each indicator is presented in the observer's rating column 1 and 2, which is then converted into a percentage. Then, the percentage results obtained were compared to table 2 to determine the profile category of chemistry teacher candidates in preparing lesson plans. After the assignment, mentoring, evaluation, and analysis, the following results were obtained.

Table 3. Data Analysis Results

Indicator	Obs 1	Obs 2	$\bar{X}$	Category (%)
Formulation of indicator competency	35	29	32	80
Organization of learning materials	31	27	29	72,50
Learning activity scenario	31	26	28,50	71,25
Media and learning tools	32	29	30,50	76,25
References	30	26	28	70
Students' affective/psycho-motor assessment	28	28	28	70
Students' cognitive assessment	31	28	29,5	73,75
Attachment	33	30	31,5	78,75

Chemistry education students as prospevtive chemistry teacher in high school and vocational school have been provided with knowledge and skills through lecture activities, such as developing lesson plans. As an experiences to become a professional teacher, the lesson plan that developed by prospective chemistry teachers in this study refers to the Standards Process and the K-13 curriculum. Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 37 of 2018 used as a Basic Competence reference to preparing

lesson plan on the certain subject. There are 10 components included in the lesson plan, namely: the identity of the lesson plan, core competencies, basic competencies and indicators of achievement of competencies (*Indikator Pencapaian Kompetensi*/IPK), objectives, learning topic, learning strategies, media and learning materials, references, teaching-learning intervention, and assessment instruments. Each component was assessed based on the lesson plan assessment indicator form. The following percentage analysis results were obtained (Figure 1).

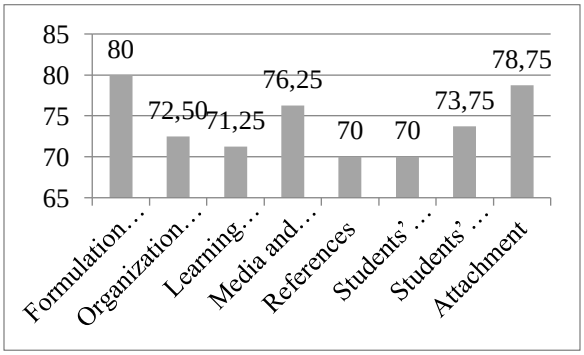

Figure 1. Percentage results of the each lesson plan aspect analysis category

Based on the questionnaire given, most of prospective chemistry teacher develop the lesson plan by referring to the material given on the related lecture, from the internet, and the lesson plan at schools, it is means that the prospective chemistry teacher still need to learn how to formulate the lesson plans independently. Figure 1 shows the percentage of prospective chemistry ability profile in developing the lesson plans. Overall, with the assignments and mentoring, prospective chemistry teacher are able to prepare the lesson plan well. The highest percentage acquisition is the aspect of competency achievement indicators (IPK) 80%, completeness of attachments (78.75%), selection of media and learning tools (76.25%), assessment of cognitive learning outcomes (73.75%), teaching materials organization (72.5%), teaching-learning intervention (71.25%), reference (70%), and of students' affective assessment (70%).

The formulation of competency achievement indicators (IPK) in this study was analyzed based on the suitability of the learning indicator formulation with learning competence, as well as the clarity of the learning objective formulation based on the format of Audience, Behavior, Condition, and Degree. Prospective chemistry teacher use the core competencies and basic competencies that stated on the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 37 of 2018 to formulate the competency achievement indicators (IPK). On the basic competency, there is more than one sub-subject. If prospective chemistry teacher develop lesson plan for one sub-subject as material in one short meeting, the competency achievement indicators and objectives that were developed also need to be adjusted. These adjustments were need to be relevant with the students' characteristics and the teaching material. One of the prospective chemistry teacher developed the lesson plan for covalent bond, which is one of the sub-subject included in Basic Competency 3.5. These basic competencies include the subject of chemical bonds: ionic bonds, covalent bonds, coordination covalent bonds, metal bonds, and their relation to the properties of substances. The example shown below.

Kompetensi Dasar

3.5 Membandingkan ikatan ion, ikatan kovalen, ikatan kovalen

koordinasi, dan ikatan logam, serta kaitannya denan sifat zat.

Indikator Pencapaian Kompetensi

3.5.1 Memaparkan proses pembentukan ikatan kovalen koordinasi dari suatu senyawa atau ion.

The formulation of competency achievement indicators adjustments was made through the use of operational verbs (KKO). Operational verbs are verbs whose can be measured, observed, tested, and used to formulating learning objectives (Anderson & Krathwohl, 2001). In the example above, it can be seen that the KKO used for basic competencies is *membandingkan* (comparing) which is the KKO of C4 bloom taxonomic level, but the formulation of the KKO that used in the competency achievement indicators (IPK) is *menjelaskan* (explaining) which is the KKO of C2 bloom taxonomic level. Through the formulas in these examples, prospective chemistry teacher still need to be given the understanding that the KKO in the formulation of competencies achievement indicators (IPK) must be equal to the KKO of basic competencies or have a higher taxonomic level (Anderson & Krathwohl, 2001). Equal means, when the operational verb (KKO) chosen for basic competence is included in the level 2 bloom taxonomy, then what is used in the competencies achievement indicators (IPK) is also KKO level 2 or above. Six of 10 prospective chemistry teachers use an unequal operational verbs (KKO). The inequality of operational verbs was an adjustment to the sub-subject chosen and the relatively short learning activity time in microteaching activities, so that learning objectives can be achieved.

Learning objectives in the lesson plan is a fundamental aspect in directing a good learning process and activity (Yaumi, 2014). Baker (2005) suggests the criteria in formulating learning objectives, namely the teacher's preference values or teacher's views and beliefs about what is important and should be taught to students, how to learn it, and behavior taxonomic analysis as stated by Bloom. Uno (2010) suggested the technical formulation of Baker's learning objectives to use format of Audience, Behavior, Condition, and Degree (ABCD). The ABCD format has been implemented by prospective chemistry teacher in the formulating the learning objectives. However, there are still several prospective teacher that still confuse to determine theobjective formulation in ABCD, as in the following example.

Tujuan Pembelajaran Rumusan ABCD:

Melalui pembelajaran pembuatan larutan penyangga, peserta didik mampu mengidentifikasi sifat larutan penyangga melalaui percobaan dengan tepat.

Tujuan Pembelajaran Tanpa Rumusan ABCD:

Setelah proses pembelajaran korosi, diharapkan peserta didik mampu:

1. *Menyebutkan faktor-faktor penyebab korosi.*
2. *Mengajukan gagasan untuk mencegah dan mengatasi faktor penyebab terjadinya korosi.*

The process of writing learning objectives begins by naming the audience which indicates to whom the learning objectives are aimed. Furthermore, the behavior shown by the student, and the conditions when the student shows the ability or behavior to be observed, meanwhile the degree states new knowledge and skills that must be mastered (Uno, 2010). Such as in the example above,

if observed the learning objectives that have been formulated by prospective chemistry teachers using the ABCD format, *peserta didik* are identified as audience, *mengidentifikasi* as a behavior, *melalui pembelajaran percobaan pembuatan larutan penyangga* as the conditions, and *dengan tepat* as the degree. In contrast with learning objectives which are formulated without the ABCD formulation, which only states the learning topics that students should be mastered.

In the lesson plan assessment rubric of the organizating the teaching materials, prospective chemistry teacher need to adjust the teaching material that covered in basic competencies with the learning objectives, student characteristics, and the teaching material. Teaching material in lesson plan that was made by prospective chemistry teacher has been systematically designed and grouped into factual, conceptual, and procedural knowledge. Some that are noted in the grouping of teaching material are the formulation of procedural knowledge if the material being taught was factual.

Faktual

Eksperimen Rutherford (hamburan sinar α)

Prinsip eksperimen: partikel α ditembakkan pada lempengan tipis emas.

Konseptual

Model atom Rutherford (atom terdiri dari inti atom yang sangat kecil dan bermuatan positif yang dikelilingi oleh elektron yang bermuatan negatif).

Prosedural

Prosedur eksperimen Rutherford

- *Partikel α ditembakkan pada lempengan tipis emas.*
- *98% sinar afa menembus lempeng emas tipis.*
- *2% sinar alfa menembus lempeng tetapi dibelokkan.*
- *0,01% sinar alfa dipantulkan.*

In addition, from the 10 lesson plan documents, the learning resources used by prospective chemistry teacher were still dominated by high school textbooks. It would be more meaningful if the teacher prepares the learning material that supported by other learning sources such as relevant research journals or university chemistry text books. These learning resources can support the skills needed in the global era so that students can explore the development of science and improve the quality of their learning abilities (Setyowibowo, 2018).

To carry out the optimal learning activities at school, a teaching intervention as a scenario of learning activity design was needed. The results of the analysis on this component obtained a percentage of categories of 71.25% or the second lowest ranking. Based on the results of the questionnaire, it is known that prospective chemistry teacher have the difficulty in the formulating a hierarchy of learning strategies: approaches, models, methods, techniques and tactics, but they are able to formulate a systematic procedure of core learning activities from the beginning to the end. One of the difficulties is the relevance between the model and the learning approach chosen in the formulation of the learning strategy. As an example some students state that they choose a constructivist approach with discovery learning models. This difficulty is more prominent in how the proposed learning model fits with the selected learning approach. This is can be a reflection for

lecture activities related to the preparation of lesson plans, how to provide easy understanding for students to determine the relevance of the chosen learning approach and model, even though they can already distinguish the definition of approaches, models, methods, techniques and tactics. Another example as shown below.

Strategi Pembelajaran Submateri Pokok Pembuatan Larutan Penyangga/Buffer

Pendekatan: Scientific
Model: Inquiry Learing
Metode pembelajaran: Ekspositori, Diskusi kelompok, Demonstrasi.

All prospective chemistry teacher use an approach that is student-centered learning. It is in accordance with the characteristics of the K-13 curriculum, which is the scientific approach. The learning model chosen is adjusted to the material being taught, most students use inquiry based learning, discovery learning, and cooperative learning models such as Jigsaw and Student Tournament Achievement Division. In the preliminary activities, substantive activities such as student conditioning, apperception, and learning objectives are listed. All chemistry teacher candidates in this study have tried to write the syntax and characteristics of each learning model in the steps of the core learning activities. Reflection, evaluation, and further learning information is written in the closing activity.

Learning strategies and scenarios that are relevant to the learning objectives, students' characteristics and learning material, will be contribute to determining the achievement of learning objectives (Anisa & Yuliyanto, 2017; Dolong, 2016). As the results of research that conducted by Dorovolomo, Phan & Maebuta (2010) there was a positive correlation between the quality of lesson plan and the implementation that carried out in the class.

Another lesson plan assessment ascpect is the learning media and tools. Prospective chemistry teacher need to pay attention to conformity the learning media and tools chosen with the objectives, learning material, and students' characteristics. The lesson plans developed for practical activities will certainly different from lesson plans for reviewing concepts or counts. In this component, prospective chemistry teacher have been able to propose media and tools that used to support learning activities accordance with the objectives and material in the lesson plan. For example, lesson plan that developed for VSEPR theory was used augmented reality and VSEPR cards. Likewise the lesson plan that developed for buffer solution was carried out by demonstration methods using laboratory equipment and materials. Therefore, the instruments and evaluation techniques used are also adjusted.

In the measurement of cognitive abilities, prospective chemistry teacher have been able to arrange questions, grids, and assessment rubrics in accordance with competency achievement indicators and learning objectives. However, affective assessment instruments have a lower percentage. Based on the results of the document analysis, prospective chemistry teacher do not develop an affective assessment scoring rubrics. For example, to assess the character of responsibility was given a score of 1 to 4; less, enough, good, very and good, without the a rubric of responsibility criteria scoring rubric. In addition, based on the results of the analysis, prospective chemistry teacher were less optimal in develop the Student Worksheet

(LKPD). Worksheet functioned for students to find concepts that they wes learned (Wulandari, 2019). All chemistry teacher candidates have develop a contextual worksheet. Some that need to be optimized in the preparation of the worksheets are the absence of open minded problems that can support the students' affective.

The results of the analysis of this study are intended to describe the profile of prospective chemistry teachers in developing lesson plan. Information results in this study can be used as a reflection and evaluation of related lecture activities. Notes that the results of this study could has different results in different subject and observation.

CONCLUSION

Based on the research results, prospective chemistry teacher was able to design lesson plan according to the criteria of standard process components well. Formulation of competency achievement indicators (80%), completeness of attachments (78.75%), selection of media/learning tools (76.25%), cognitive learning outcome assessment (73.75%), organization of teaching materials (72.5%), learning activity scenarios (71.25%), as well as the selection of learning resources and affective assessment (70%). Prospective chemistry teacher having difficulty in formulating operational verbs of learning indicators related to learning objectives and evaluation instruments, and determining learning strategies. These results can be used as a reflection and evaluation of related subject lecture activities. So that, prospective chemistry teacher can be trained to have better pedagogical competencies to become professional teachers.

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