Development of the learning design ability in the vocational context for pre-service chemistry teachers

Desarrollo de la capacidad de diseño de aprendizaje en el contexto profesional para los profesores de química en formación

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Abstract

Differences in the nature and purpose of learning chemistry in general schools and vocational schools have implications on the need to prepare specific capabilities for pre-service chemistry teachers. This study aimed to examine the basic ability of pre-service chemistry teachers in designing learning through the development of pedagogical content knowledge (PCK) in the context of vocational training. This study was designed as a descriptive study. Participants (26) in this study were students of third level on chemistry education study program of Yogyakarta State University in Indonesia who are taking the subject of vocational chemistry. Preparation of pre-service chemistry teacher's ability was conducted through collaborative learning in small groups, class discussions and ends with an independent assignment. There are three instruments used in this study. They are questionnaire, analysis of the chemistry content appropriate in vocational context, to construct content representation (Codex) and to construct pre- and professional experience repositories (P-Ps and P-Ps).

Los tres instrumentos fueron la hoja de evaluación de la capacidad de analizar el contenido de la química apropiado en el contexto profesional, la construcción de la representación del contenido y para la construcción de repositorios de experimentación pre-profesional y profesional. El resultado mostró que los licenciados de química tienen una buena capacidad de aprendizaje en el diseño del curso de química en el contexto profesional. La implicación principal de esta investigación es la necesidad de una reestructuración del currículo para licenciados en la educación profesional con el contexto de las escuelas de formación profesional.

Palabras clave: diseño de aprendizaje, representación de contenido, experiencias pre-profesionales y profesionales, profesor de química, conocimiento didáctico del contenido

INTRODUCTION

One of the capabilities that are important for the teacher's role as a controller of learning in the classroom is the ability to design teaching. Learning design is very important because it is used as a guide for teachers in implementing the learning to achieve the expected goals. In particular, a pre-service chemistry teacher at a vocational school must have a good ability to develop learning chemistry in accordance with the vocational context. There are two things that are associated with the ability of pre-service teachers in designing teaching. Both of these are a foundation of knowledge and thinking framework for teachers in designing learning in order to create a wide variety of learning conditions conducive to facilitate student learning. The development of knowledge and thinking is important for teachers in designing learning in order to create a wide variety of learning conditions conducive to facilitate student learning. The development of knowledge and thinking is important for teachers in designing learning in order to create a wide variety of learning conditions conducive to facilitate student learning. The development of knowledge and thinking is important for teachers in designing learning in order to create a wide variety of learning conditions conducive to facilitate student learning.

RESUMEN

Las diferencias en la naturaleza y el propósito del aprendizaje de la química en las escuelas, tienen implicaciones sobre la necesidad de preparar los profesores de química con las capacidades específicas. Este estudio tiene como objetivo examinar la habilidad básica de los estudiantes de tercer nivel de química en el contexto de la formación profesional. Los participantes (26) de este estudio eran estudiantes de tercer nivel sobre programas de educación de la química de la Universidad Estatal de Yogyakarta en Indonesia. El trabajo se llevó a cabo a través del aprendizaje colaborativo en grupos pequeños, discusiones en clase y terminaron con una asignación independiente.
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Collaborate in the group to discuss the theory of PCK and practice of constructing CoRe of chemistry in the vocational context of automotive engineering. Furthermore, each of pre-service chemistry teacher constructing a CoRe in vocational context for the petroleum topic. Collaborate in the group to discuss the theory to construct of PaP-Ers. Furthermore, each prospective teachers constructing their PaP-Ers in chemistry in vocational context for a particular concept in petroleum topics. Some examples of concepts taken are the quality of gasoline, the combustion of petroleum fuels and alternative fuels.

Research instruments

There are three instruments used in this study. First, the assessment sheets of the ability to analyse the chemistry content appropriate to the vocational context. The preparations of these instruments were developed based on the capabilities needed by teachers to determine the essential concept to be taught in vocational schools according to students' needs. There are two aspects were assessed namely the ability to analyse BC-C and to integrate BC-C with BC-V. The ability to analyse BC-C is developed into three indicators related to the ability of pre-service teachers in designing BC-C and identifies the essential concept. While the second aspect is developed into four indicators related to the ability to choose the BC-V related to chemistry learning, choosing BC-C suitable with vocational context and develop chemistry content of vocational context.

Second, the assessment sheets of the ability to construct CoRe. The indicators of ability assessment to construct CoRe are developed by reference to the questions in the preparation of CoRe according to Loughran (2006) and added the questions related to the accuracy in selecting the main ideas on a topic that will be taught according to the vocational context. Thus there are nine indicators of assessment of ability in constructing CoRe.

Third, the assessment sheets of the ability to construct p-PaP-Ers. Assessment indicators to assess the ability of prospective teachers in constructing p-PaP-Ers adapted based on analysis of p-PaP-Ers according to Mulhall et al. (2004) with an emphasis on the didactic aspect to anticipate situations that may occur in learning. There are six assessment indicators, namely the ability to formulate objectives, analysis of the difficulties in the content teaching, accuracy of learning strategy selection, the depiction of the interaction of teachers and students, the anticipation of difficulties in learning and how to understand the student's understanding.

Assessment rubrics are developed for the three instruments as guidance criteria. Scores given are 5, 4, 3, 2, and 1.

Data Analysis Techniques

The data are obtained from the assessment results of the chemistry content matrix in vocational context, chemistry CoRe in vocational context and p-PaP-Ers in vocational contexts compiled by pre-service teachers. Descriptive analyses was used to determine the ability achievement of pre-service chemistry teacher. The Percentage of achievement every aspect of designing learning ability is examined by dividing the score obtained with the ideal score. Furthermore, the average percentage of achievement is categorized into five criteria. Very good criteria for the percentage range 81-100, good for 71-80, sufficient for 56-70, less well for 41-55 and much less to the percentage of less than 55.

RESULTS AND DISCUSSION

Results

Ability to design learning in this study is intended as the ability to develop a foundation of knowledge and framework thinking teachers who are started from the content knowledge to be used as a guide to create a lesson plan that will be implemented in the classroom.

The ability of pre-service teacher’s to analyse the chemistry content in vocational context.

Based on the results obtained by analysis of mean score capability to analyse the chemistry content that achieved pre-service teachers after the learning is amounted to 25.36 and is included in good criteria. The highest obtained by pre-service teachers is 30 or 85.7% of the maximum achievement. The lowest score achieved is 18 with the level of achievement only of 51.43%. Figure 1 presents an overview of the distribution of criteria for the achievement of the ability to analyse the chemistry content in vocational context by pre-service teachers. The largest percentage (41.0%) of achievement the ability of pre-service chemistry teacher’s to analyse the chemistry content in the vocational context is in category pretty good.
The first thing to be done by the pre-service chemistry teachers in developing the CoRe document is to define the main ideas in the petroleum context according to the automotive engineering vocational context. A discussion of this main idea has been done at the previous learning when the pre-service teachers developing matrix chemistry content of vocational context automotive engineering. Results of previous class discussions concluded that there are seven main ideas in the petroleum content emphasized to be taught to vocational school students of Automotive Engineering program.

However, the data in Figure 6 shows that not all the main ideas are raised by pre-service chemistry teachers. Only three main ideas were raised by all of them (36), namely the idea of fractionalization of crude oil, gasoline and diesel fuel.

The ability of pre-service teacher ’ s to construct the chemistry p-PaP-eRs in vocational context.

The results of an assessment of the p-PaP-eRs documents showed that the average total score obtained is 18.6 and included in the criteria pretty well. The criteria of lowest score of p-PaP-eRs is very poor with a total score of only 9 or 30% of ideal achievement. Meanwhile, the p-Papers with the highest score amounted to 25 with a 83.3% of ideal achievement. The distribution of criteria for constructing p-PaP-eRs is presented at Figure 7.
DISCUSSION

The results of the study showed that the average achievement of ability of pre-service chemistry teachers is pretty good. Judging from the three aspects, only the first aspect i.e. ability to analyze the chemistry content of vocational context that can be prepared effectively. Ability to analyze the chemistry content of vocational context are relatively better compared to the other aspect because of is supported by prior knowledge of pre-service chemistry teachers. Such knowledge includes basic concepts of curriculum, high school chemistry curriculum as well as how to determine the content that should be studied to achieve certain basic competencies. Knowledge of the curriculum is supporting pre-service teachers' ability to formulate a relationship between topics to build students' prior knowledge and provide the necessary assistance to study topics in the future (Lankford, 2010). Chemistry content analysis capabilities that fit the vocational context require training for pre-service chemistry teachers. Research results of Karsian et al. (2013) stated that most teachers have limitations in developing PCK in the classroom, especially related how to determine the content that should be taught to meet the overall goal.

While the second and third aspect of ability in designing learning in vocational context are not well enough that requires knowledge and experience that is more complex in order to achieve the optimum result. Constructing a Core document requires a good basic understanding of the content and pedagogical knowledge. Constructing p-Pal-Res requires a comprehensive rationale about a content strategy in teaching as well as experience and reflection on learning. In this study, pre-service teachers had never devised a p-Pal-Res before, and have not experienced teaching petroleum content to students, either in general schools or vocational schools.

In the second aspect, there are four indicators with the level of achievement 'less good' and only one indicator reached a 'good level'. The indicator with the lowest mastery is the ability to determine how to make sure the students understanding. Most of pre-service teachers still rely on pencils and paper tests as a way to ensure student understanding, not yet familiar with the alternative assessment. Meanwhile in the third aspect, there are two indicators with 'less good' level of achievement and just one indicator with level of achievement of good. The indicator with the lowest level of mastery is the ability to anticipate the difficulties that may be encountered in learning. Limited experience teaching practices inhibit pre-service teachers in predicting the difficulties that may be encountered when teaching the content of petroleum, especially for vocational students.

This supports previous studies which state that the understanding of the students, including students' perceptions about learning affects the ability of teachers to develop its PCK (Jong & Chun, 2009).

CONCLUSIONS

After participating in learning, pre-service chemistry teachers have a pretty good ability in designing chemistry learning in vocational context. Pre-service chemistry teachers have a good ability to analyze the chemistry content in vocational context, a pretty good ability in constructing chemistry Core in vocational context and a pretty good ability in preparing chemistry p-Pal-Res in vocational context. The main implication of this research is the need for restructuring the curriculum for pre-service chemistry teacher education programs that are more concerned with professional development in the context of vocational schools.

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