The Needs Analysis Development of Subject-Specific Pedagogy (SSP) Blended Learning Based on Multiple Representatives in Chemistry at SMA Negeri 3 Kupang Timur

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Abstract. This study is intended to analyze the needs of subject-specific pedagogy blended learning multiple-representative based in chemistry learning at SMA Negeri 3 Kupang Timur. The subject of this study is all students of the 11th grade majoring in natural science and the chemistry teachers at SMA Negeri 3 Kupang Timur. Data is collected by interviewing the teachers' needs and questionnaires of students' needs. Design Based Research (DBR) is used in this study. The result of the study shows that teachers cannot make a comprehensive and systemic learning tool.

Furthermore, the students require a more accessible learning tool to access it out of the learning activities. The students also require innovative learning media to make it easier for them to grasp the chemistry subject. Therefore, it requires a development of subject-specific pedagogy blended learning based on multiple representatives in helping the students and teachers in chemistry learning process.

Keywords: Subject Specific Pedagogy · Blended Learning · Multiple Representative · Chemistry

1 Introduction

Development in science and technology has brought us to a more sophisticated era, including the education field [1]. Technology, Information, and Communication play a significant role in various aspects [2]. In education, the role of technology in industry 4.0 is more significant. Hence, as the learning activities emphasize several aspects of the 21st century, one of them is that teachers and students must be able to implement and master the technology [3]. Chemistry is one of the high school subjects, and vocational high schools are certainly developed under the 21st-century learning demands. It means that teachers must implement technology in every aspect of the material taught to the students. Nurkholis argues that education in Indonesia should be able to compete and take an active role in the globalization era, so we do not leave behind other countries of the world [4]. Therefore, it requires a learning strategy that accelerates face-to-face learning between teachers and students and in learning activities using technology.

It is in line with Graham, Allen, and Ure's opinion (2003). They state that blended learning is an approach that combines face-to-face and online learning by using online learning resources and various choices of communication that can be used and can be accessed by the teachers and students [5]. Apart from technology needs, students also require a learning mode that can answer students' imagination related to chemistry. Because most chemistry learning activity in schools is still dominated by teachers and the delivering concept is less contextual, the chemistry concept abstraction is challenging to understand, impacting the weakness of critical thinking skills. It is also due to a lack of teacher's competency in designing learning activities [6]. The learning model that can answer the shortcomings is the multiple representative learning models. Multiple representational has three main functions, as a complement, as constraint interpretation, and build up understanding [7]. Blended learning strategy and multiple representational can be poured into a learning tool like Subject Specific Pedagogy (SSP).

The learning tools, like Subject Specific Pedagogy (SSP), is a packaging of study material into a set of comprehensive and educational learning tools [8]. The components of SPP include syllabus, Semester Lesson Plan, Student Worksheet, module, and assessment instruments. So far, there has been no SPP blended learning, while the 21st century requires students to be technology literate (ICT literacy). Alismail (2015) in her study reveals that future studies or researches should consider wih be curriculum implications and the 21st- century learning to prepare teachers with suitable ways in applying 21st-century skills and can integrates the multimedia technology [9]. Consequently, SSP blended learning must be developed based on multiple representational, particularly in chemistry learning (Table 1 and 2).

2   Method

Table 1. List of Question.

No	Question	Answer
1	Has the teacher applied the Curriculum 2013?	Yes, she/he applied it.
2	Did the teacher use the syllabus related to the applied curriculum?	Yes, she/he did.
3	Did the teacher use the material related to the core competencies in the syllabus?	Yes, she/he did.
4	How much is the chemistry's Minimum Criteria of Mastery in the school?	75

(*continued*)

Table 1. (*continued*)

No	Question	Answer
5	Did the teacher know about subject specific pedagogy?	No, she/he did not know about it.
6	Has the teacher made comprehensive learning tools (including syllabus, lesson plan, module, student's worksheet, and assessment worksheet?	She/he has made some learning tools: lesson plans, student worksheets, and assessment worksheets. She/he never did a module due to the time limit and did not understand how to do an exciting module. The module she/he used is a chemistry textbook, and she/he downloaded the online module as an additional reference in chemistry learning activities.
7	What learning models did the teacher use in designing the learning tools?	There were a few of them, guided inquiry, lecture, and discovery learning.
8	Can the learning model in teacher learning tools deliver the chemistry material in macroscopic, sub-microscopic, and symbolic levels?	No, it cannot deliver the levels.
9	If it is not, does the teacher need a learning model that can deliver the chemistry material at those levels?	Yes, she/he does. She/he needs it
10	Did the teacher know about multiple representations?	No, she/he did not.
11	Is the time allocation of the chemistry lesson enough to explain all the materials?	The time is limited and not enough to explain it all. We will miss a lot in the last chapter if the teacher tries to reiterate the materials.
12	Does the teacher think it is necessary to have a learning strategy that combines online and face-to-face learning?	Yes. It requires a combined learning strategy so the students can study out of class hours.
13	Did the teacher know about blended learning?	Yes, she/he did. Blended learning is a learning combination.
14	Does the teacher need a digital learning tool to help his/her in chemistry learning activities by using technology corresponding with the learning demands of Curriculum 2013?	Yes, she/he does need it. She/he hopes that the digital learning tool can facilitate the students to access the material to be studied and that students' learning is not biased.
15	Does the teacher agree with developing blended chemistry learning tools based on multiple representations?	Yes, she/he agrees with it.

Table 2. The Answer of Statement

No	Statements	Answer	
		Yes (%)	*No (%)*
1	It is difficult for students to understand the chemistry material given by the teacher	89,6	10,4
2	The chemistry textbook shared by the teacher spurs learning independence	35,7	64,3
3	The teacher uses a creative learning method, and the student is enthusiastic about learning chemistry	29,2	70,8
4	The student needs a learning module that facilitates him/her to grasp the chemistry lesson	98,9	1,1
5	The student needs an accessible chemistry module via smartphone	100	0
6	The student hopes there is a module using concrete examples in daily life.	100	0
7	Student needs appropriate learning in the environment	78,4	21,6
8	The student is bored if the learning activities are only conducted directly in the class (face-to-face)	69,8	30,2
9	If the learning is entirely online, the student is not severe.	71,5	28,5
10	The student agrees with idea of blended learning (a combination between face-to-face learning and online learning)		0

3   Discussion

The chemistry teacher's interview resulted in some information that is divided into three aspects:

3.1   The Learning Tools

The teacher has provided the learning tools. However, they have been only lesson plans, student worksheets, and assessment instruments, whereas the teacher has not created the module. She/he uses a chemistry textbook in the learning. Often, to supplement the references, the teacher downloads online material and delivers it to the students in the class learning process. It indicates that the teacher's learning tools are not comprehensive. Teachers should understand lesson plans based on the applicable curriculum, so there is no confusion in making lesson plans (book or module).

3.2   The Learning Model

Based on the interview result, the learning model used by the teacher includes guided inquiry and discovery learning that is supported by lectures and questions and answers between the teacher and the students. In addition to these learning models, there is no other learning model used because the teacher has not had enough time to design various

learning models. Moreover, the teacher has no idea about the multiple representative learning models, so a learning model has never been designed to deliver chemistry material into macroscopic, submicroscopic and symbolic levels. Process. If it is only face-to-face learning, the students will become inactive due to the one-way learning. Otherwise, they will not join the learning process seriously if it is only online learning. It can be seen in the 8, 9, and 10 statements. The percentage of students who agree with blended learning is 100%.

Educating implies that the learning activities have to be well designed and planned. A good learning is not just prioritizing on knowledge aspect but also focusing on shaping students attitudes, character and behavior [10]. In her study, Wardani expresses that a blended learning is a learning model that can increase attractiveness in direct learning or face to face learning and is appropriate to be applied in the 21st era [11]. Blended learning can accommodate a spacious technology development without leaving face-to-face classroom learning by combining it with e-learning. Blended learning will solve a common problem in the educational system if it is properly planned and organized correctly [12]. It can be poured into the learning tools used by the teacher. Moreover, multiple representational examples can be used to answer students' needs about an understandable module learning and containing concrete examples in daily lives. Knowledge levels in chemistry learning not only include macroscopic, sub-microscopic, and symbolic but there is a human element [13].

Waldrip's study result states that multi modal demand is pretty significant for the students. However, it potentially makes the learning more effective [14]. Representation of chemical concepts generally involves more than one combination of representation models. This model can be used in chemistry learning module development. Fatmala, Nyeneng, and Suana reveal that the multi representation-based contextual learning module has several advantages. The teaching material product is arranged in gradual steps following the contextual learning syntax. The students can use it independently; it is presented with various representations (multi representation), making it more manageable for the respond to lack or time limitations in school so that teachers and students can discuss outside school hours. With the digital learning tools that are packaged in the learning management system (LSM), students facilitate to find learning resources, and they can learn independently.

Based on the questionnaire of students' needs at SMA Negeri 3, Kupang Timur obtains that the students require engaging learning media and appropriate daily life examples to understand it. It can be seen in the statements numbered 4,5, and 6. Furthermore, the students also need innovation and not monotonous. It is blended learning, so they do not get bored in the learning.

students to understand the material [15]. Besides being used in class, students can use the module independently to achieve the learning objectives so they can develop on their own [16]. SSP is a form of teacher's knowledge and thought process. The additional learning indicators affect the SSP.

4   Conclusion

Based on the preliminary needs analysis at SMA Negeri 3 Kupang Timur, the researcher carries out the SSP blended learning multi-representative based on chemistry learning to help students grasp the chemistry material and facilitate the teacher in preparing lesson planning. In this multi-representative blended learning, teachers are facilitated with well-structured learning activities, whereas the students can easily access the materials appropriate to their environment. Therefore, research will be conducted to develop SSP blended learning multi-representative based on chemistry learning.

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