Profile of food chemistry lectures in chemistry education program: A descriptive study on the fulfillment of competency standards of chemistry teacher candidates

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Abstract. The Ministry of Research-Technology and Higher Education of Indonesia has established competency standards and Learning Outcomes (LO) for chemistry teacher candidates. The fact is that until now chemical education in school is still far from expectations. One of the subjects in the department of chemistry education which has a responsible for the fulfillment of competence is food chemistry. Food chemistry is one of the elective courses provided to prospective chemistry teachers in most of Teacher Education Institutions (TEI). Descriptive study has been conducted to picture the implementation of the food chemistry lectures from the perspective of the curriculum, the learning process, and the students’ views. The subject involved were, secondary data (curriculum) from six (6) TEIs, students, and classroom activity. The data were interpreted by triangulation to make a conclusion. The results showed that lectures have not fully accommodated the LO according to competency standards expectations. The lectures have accommodated the fulfillment of conceptual achievement, but still lacks the building of high-level skills of such as problem-solving skills and evaluative thinking skills. The recommendation of this research is the need to reorient the curriculum of food chemistry course and its implementation in the lecture.

1. Introduction
The Government has attempted to develop and establish the Indonesian National Qualification Framework (INQF) to prepare qualified and highly competitive workforce. INQF becomes a reference in establishing the Standard Competency in the College. Competency Standards Graduates have at least a qualification that includes attitudes, knowledge, and skills. The standard competencies are expressed in Learning Outcomes formulas and elaborated by each study program such as the Chemistry Education Department in the Indonesian TEIs MIPA Forum.

This Learning Outcomes Chemistry Education Department has elaborated the competence of attitude, knowledge and skill. Each of these competencies is detailed again as follows of the ten-component attitude, the five components knowledge, and Skill competencies are outlined in the general skills of nine components and the special skills of the five components [1].

This Learning Outcomes is a reference for each course held in the Chemistry Education Department including Food Chemistry lectures. Planning, process and evaluation of Food Chemistry lecture should also refer to the demand of INQF which includes attitude, knowledge and skill. Based on this
background, the research problem is "How is the Food Chemistry Lectures profile on some Chemistry Education Department".

2. Method
This research is done by descriptive method. The Research subjects were Food Chemistry Lectures in six TEIs Chemistry Education Department on Java and Sumatera and students’. This research was conducted for 7 months from February until August 2017. The instruments used in this research include the format of lecture document analysis, evaluation instruments, and interview guidelines. The data collected were obtained from the analysis of the lecture documents, test and interviews. The data were analyzed to get a clear picture about the implementation of Food Chemistry lecture.

3. Result and discussion
Food Chemistry Lecture is an elective course that is generally implemented in the odd semester of each academic year. The findings that will discuss about Learning Outcomes, Learning Process and Evaluation of Food Chemistry lecture.

3.1. Learning outcomes
The result of document analysis of Lesson Plan of Food Chemistry indicates that all Chemistry Education Department contain knowledge as Learning Outcomes. Three Chemistry Education Department in Java (UJ 1, UJ 2 and UJ 3) have included attitudes as Learning Outcomes. One study program on Java that is UJ 1 lists the skills as Learning Outcomes as can be seen in figure 1.

![Figure 1](image-url) Learning outcomes of food chemistry lectures in chemistry education department on Java (UJ 1 UJ 2, UJ 3, UJ 4) and Sumatera (US 1 and US 2).

The Lesson Plan Food Chemistry in three Chemistry Education Department included Learning Outcomes have included attitudes but not all competencies. UJ 1 only lists components 1; 4; 8, that are Be cautious of the Almighty God and capable of showing a religious attitude: Acting as a citizen of pride and love of the homeland, had nationalism and sense of responsibility to the state and nation: Internalize academic values, norms, and ethics. UJ 2 only includes the Ninth component that is Demonstrate the responsible attitude of the work in the field of expertise independently. UJ 3 has listed the components 3; 4; 5; 6; 7; 8; 9 that are Contributed in improving the quality of life of society, nation, state, and progress of civilization based on Pancasila: Acting as a citizen of pride and love of the homeland, had nationalism and sense of responsibility to the state and nation: Internalize academic values, norms, and ethics; Cooperate and have social sensitivity and concern for society and environment; Obey the law and discipline in the life of society and state; Internalize academic values, norms, and ethics; Demonstrate a responsible
attitude towards the work in his own field of expertise independently. Competence of skills listed by UJ 3 is only component fifth that is able to take decisions appropriately in the context of problem solving in the area of expertise, based on the results of analysis of information and data [1]. The Chemistry Education Department in Sumatera and UJ 4 only includes knowledge and has not included the attitude and skill competency aspects. So, Need the development of Food Chemistry Lesson Plan that can actualize the aspect of competence Attitudes and Skills as well as knowledge.

3.2. Learning process

The result of document analysis of Lesson Plan of Food Chemistry and lectures in Chemistry Education Department conducted teacher centered, assignment, discussion, question and answer and group presentation method. One Department used a society / environmental approach, ethnosciences, on every lecture topic. Others used the Think Pair Share model on the topic of food additives and conducts Practicum as can be seen in table 1.

| An Approach/Method and Models | UJ 1 | UJ 2 | UJ 3 | UJ 4 | US 1 | US 2 |
|------------------------------|------|------|------|------|------|------|
| 1. Environmental approach    |      |      |      |      |      |      |
| 2. Community Approach        |      |      |      |      |      |      |
| 3. Etnosains                 |      |      |      |      |      |      |
| 4. Think Pair Shair          |      |      |      | √    |      |      |
| 5. Inquiry                   |      |      |      |      |      | √    |
| 6. Project                   |      |      |      |      |      | √    |
| 7. Expository                |      |      |      |      |      |      |
| 8. Teacher Centered          | √    | √    | √    | √    | √    | √    |
| 9. Giving assignment         |      |      |      |      |      |      |
| 10.Discussion                |      |      |      |      |      |      |
| 11.Question and answer       |      |      |      |      |      |      |
| 12.Group presentation        |      |      |      |      |      |      |
| 13.Practicum                 |      |      |      |      |      |      |

Based on interviews with students and lecturers of food chemistry in lecturers stated that the lectures were conducted with group strategy. Each group carries out the task of studying material from various sources such as books, internet, community and others, then submitted in the form of papers and presentations in class discussions. The presentation of the material is presented conceptually. Students only understand these concepts by reading the existing references. Students deliver what is found and not required to analyze issues according to the topics they discuss so as not yet maximally develop thinking skills.

Food Chemistry lectures are conceptual, whereas Food Chemistry is an existing problem in everyday life, environment and society that can be used as a learning resource so that learning is more interesting. Lectures that match what they experience will cause students to be more interested in lectures [2]. The placement of science as a social phenomenon, connected to applied technology in everyday life, is assumed to turn science into a subject more relevant, meaningful and appealing to students [3].

Lectures are also carried out separately on a specified topic, whereas Food Chemistry material is interdisciplinary subject that is interrelated [4]. Examples of protein materials discuss is protein sources in the environment, chemical content, benefits to the body as well as the impact health. The protein topics are related to the damage experienced for food containing protein, the causal factors and the type, and how to overcome the damage done by the community with preservation and processing. In addition, also discussed what additional food ingredients used by the community in preservation and processing.
and its impact on health, and how the packaging used by the community to extend the food and attract food.

3.3. Evaluation of learning

The results of the analysis show that the evaluation of Food Chemistry Lectures conducted in general is more emphasis on knowledge through Midterm exam, Final exam, papers, quiz, task, presentation. Lecture evaluation is still little done on attitude, skill, literacy, product, performance, fortfolio forfolio as can be seen Figure 2. This is in accordance with the analysis of test that can be concluded that the evaluation made more emphasis on knowledge. Students are asked to explain the concept as students are asked to explain the classification of carbohydrates, carbohydrate functions for humans, protein classification, fat destruction, about vitamin classification and vitamin function.

![Figure 2. Evaluation of food chemistry lectures at four TEIs in Java (UJ 1; UJ 2; UJ 3; UJ 4) and two in Sumatra (US 1; US 2).](image)

Evaluation of attitudes and skills has not been done according to INQF demands. Evaluation of skills performed in the form of performance and skills generic science. Students have not been required to develop thinking skills such as problem solving and evaluative thinking. This is not in accordance with the demand of INQF which requires the ability to think as a work skill is also a mastery of knowledge that must be mastered [1].

Problem-solving skills are essential in many areas of employment as well as for a prospective teacher. In addition to useful for prospective teachers themselves, this skill is also expected to be a provision for a prospective teacher to in solving problem-solving abilities on their students later when they teach in high school. This can improve the problem-solving ability of Indonesian students who are still low who earn an average score of 361 and is the 37th of 38 participants. This is because our students are not trained in solving problems. Therefore, it is very necessary for prospective teachers in mastering problem-solving skills to be able to provide for students when they become teachers later. The ability to solve problems, math, science and reading will not only determine the personal success of the students but also the determinants of the success of a society and nation [5]. Problem solving requires evaluative thinking and should be an important learning outcome that good chemistry teaching should aim at. [6]

The findings can be summarized that the lecture of Food Chemistry in the Six Department hasn’t been optimally implemented in accordance with the demand of INQF. The formulated learning outcomes have not achieved the optimal learning outcomes that can be accomplished. Implementation of learning using lecture methods, group discussions, frequently asked questions, presentations and still theoretical and delivery of separate materials on one particular topic. Evaluation of learning that is done
more emphasize the knowledge cause learning outcomes is not achieved with optimal expected from lecture of Food Chemistry. Therefore it is necessary to develop the Food Chemistry lecture which can actualize the learning outcomes of Food Chemistry to achieve the expected competence for a teacher candidate in accordance with current INQF demands.

Food Chemistry is applied lectures. Students are expected to apply the knowledge learned in this course to explain the phenomena studied in the course. Students can apply the concept of redox in the process of Food Chemistry, the concept of organic chemistry and biochemistry in choosing a good food source as needed, the concept of harmful chemicals in avoiding the use of additives in food. Food Chemistry deals with biochemistry, chemistry, biology, geology, economics, mathematics, health, technology, environmental science, social sciences [7].

The Food Chemicals course is very useful and deals with daily, applied, interdisciplinary life, so the approach of Science Technology Society and Environment (STSE) is a potential approach to use. The STSE approach has been implemented in countries such as Israel, Turkey and Canada. The science curriculum focuses on Science, Technology, Society, and Environment (STSE) for students to deal with the impact of science on society, and the need to bring issues related to human values [8].

The STSE approach makes connections between students and real life. Environment is a place where students can gather data for their problem solving, consider alternative ways of solutions, determine the best way to solve their problems and practices [2]. The integration of social and / or environmental issues into science and technology lectures makes learning meaningful and better understood by students. Connecting science with social phenomena and technology applied in everyday life is assumed to make science more relevant and meaningful for students [9].

The STSE approach improves the learning outcomes of non-science environmental science [10, 2] and have a positive impact on student self-efficacy in terms of environmental concerns [10]. Students become more interested and motivated thus increasing their increased learning interest [7]. Lectures using existing materials around them can enhance the ability to think creatively [11]. STSE approach can develop students’ critical thinking and scientific thinking skills, and to improve their problem-solving abilities [3], improve decision-making ability [12, 13], system thinking and evaluative thinking skills [13]. Learning with the STSE Approach may develop high cognitive skills or High Order Cognitive Skills (HOCS) students [7,12,13, 14,15, 16].

The STSE approach enable students to participate in teamwork that develop skills, actions and attitudes such as cooperation, communication, engagement, adaptability, mutual support and individuality acceptance of each team member that will be important to them as citizens [7]. In addition they learn to organize work, students are taught to use all available resources to find data, keep records and finally, to interpret, evaluate and use the information they collect, add their own comments and earn satisfaction making their own individual contributions to project [7].

4. Conclusion
The results of this descriptive study provide a description of the profile of Chemistry lectures on several Chemistry Education Department as follows. 1) Food Chemistry Learning Outcomes whole has not actualize such Learning Outcomes attitudes and skills competence. 2) Lecturers are conceptual, generally using Teacher centered methods, group discussions, and have not utilized the real-life problems that exist in the environment and culture that exist in society and lecture materials are conducted separately based on the topic of the material. 3) Evaluation of learning that is conducted in the subject is more emphasis on knowledge, still little to measure students' thinking skills such as problem-solving skills and evaluative thinking. 4) Based on these findings and the characteristics of the course it is necessary to reorient the Food Chemistry lectures to achieve the expected competence of a prospective teacher in accordance with the demand of INQF and the Science Technology Society Environment (STSE) approach is potential to be used.
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