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ANALYZING CREATIVE THINKING SKILLS OF CHEMISTRY EDUCATION STUDENTS WITHIN BASIC CHEMISTRY

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ABSTRACT

Creative thinking skills is one of important skills in 21st century, especially for the teacher in chemistry major, creative thinking skills involved four indicators are originality, fluency, flexibility, and elaboration. This research conducted by online questionnaire from 190 chemistry education students from second semester until eight, the question is about basic chemistry consists of 14 themes. The highest score happen in first theme in first indicator, and the lowest score happen in 11st theme in fourth indicator. The conclusion is the students are in creative category, even though are lowest in elaboration indicator in whole basic chemistry and highest in originality indicator. Basic chemistry knowledge, they mastered in atom and periodic system of elements and low knowledge about physical properties of the solution

Keywords: *creative thinking skills; chemistry education students; basic chemistry*

INTRODUCTION

Chemistry education students are role models for their students when they become teachers, of course, a role model is required to have skills when delivering learning, including creative thinking skills. Creative thinking skills will be needed both when teaching and moreover when preparing learning preparations or in curriculum [1], [2], so students who are taught will receive learning with enthusiasm and understand the concepts that are the objectives of learning [3-4], even though chemistry is considered difficult by many students, because teachers who teach creative in deliver lessons. So that creativity of human resources as a determinant of the nation's competitive power [5].

Creative thinking skill built from the creative process, it is problem-solving activity in cognitive abilities such as analysis, generation, evaluation, and implementation [2], [4], [6], [7] so that to know creative thinking skills someone, it is

can be know how he solve the problem using his analysis, generation, evaluation, and implementation. Creative thinking skills have indicators involving fluency, flexibility, elaboration, and originality [8-10].

Creative thinking skills have several characteristics that are defined as follows 1) originality interpreted as someone's uniqueness when giving an idea in solving a problem, such as predicting the future about a device, thinking about what can be done from the use of a tool, or how it can be done in calculating something, 2) fluency is the ability to create many new ideas, 3) flexibility is one's ability to adapt creative ideas to various problems that must be resolved, 4) elaboration is communicating creative ideas to others. If the idea is considered complicated, then someone who has the ability to think creatively must be able to decipher it into simple things that can be explained [11]. People who have creative thinking ability believed that they were more open to take risks with their ideas and encourage them to step out from their comfort zone, and increase their self-confidence in their own creative abilities [12] to be innovative and competitive also for learning can integrate a new knowledge [10].

This research is aimed to analyze how creative thinking skills from chemistry education students about basic chemistry, as information how our education in next period to be and consideration for the lecturers in education university to teach their student.

RESEARCH METHOD

This research used qualitative method with descriptive design [13]. The research conducted by online questionnaire with 56 questions to 190 students of chemistry education, 56 question consist of 14 basic chemistry content , each content consist of four creative thinking skills indicators, involve originality, fluency, flexibility, and elaboration. The basic chemistry contents consist of Atomic and periodic table of elements, Chemistry bond, molecule geometry, Intermolecular, Hydrocarbons, Hydrocarbon derivatives, Benzene derivatives, Biomolecule, Stoichiometry, Thermochemistry, Physical properties of the solution, Equilibrium, Acid base, and Electrochemistry.

RESULT AND DISCUSSION

The data was collected from 190 respondents, every respondent has different answer according his creativity to give the answer. The question is essay, so that the respondents can answer freely as he thinking creatively.

1. Creative Thinking Skills from Chemistry Students within Basic Chemistry Content.

Creative thinking skills should have by the teacher, especially to transfer the knowledge to the students, this is also need by chemistry teacher, even though learning chemistry is regarded as difficult subject matter. therefor the researcher here try to collect the information from several chemistry pre-service about their creative thinking skills, it is involved four indicators originality, fluency, flexibility, and

elaboration. The research conducted through basic chemistry content, because consider that the youngest chemistry education student in this semester is second semester, where they have gotten basic chemistry in the class, then this research questions can be answered by whole chemistry education students.

Table 1. Percent score of creative thinking skills from chemistry students within basic chemistry content

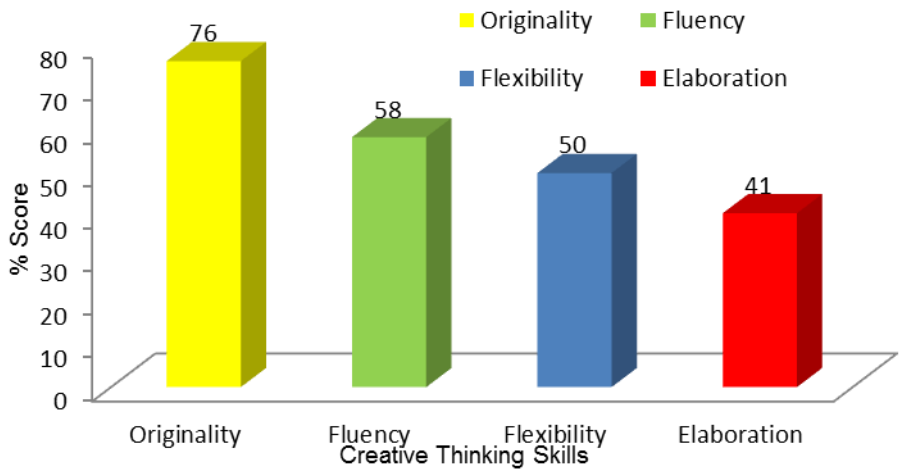
Content of Basic Chemistry	Percent Score of Creative Thinking Skills			
	Originality	Fluency	Flexibility	Elaboration
Atomic and periodic table of elements	99	91	66	66
Chemistry bond	86	70	59	48
molecule geometry	91	57	45	38
Intermolecular	95	75	60	64
Hydrocarbons	72	63	41	27
Hydrocarbon derivatives	83	72	64	53
Benzene derivatives	78	64	53	51
Biomolecule	68	27	64	53
Stoichiometry	82	53	61	45
Thermochemistry	78	53	44	34
Physical properties of the solution	12	7	7	4
Equilibrium	65	59	46	25
Acid base	89	79	66	40
Electrochemistry	69	48	22	22

Table 1 shows how respondents score from every creative thinking skills indicator in every basic chemistry content, it is can be concluded, which is the highest score and the lowest score in every indicator and chemistry content. The highest score got from originality indicator from atom and periodic system of elements (99%), and the lowest one is elaboration indicator from physical properties of the solution (4%).

Picture 1 draws the graphic that most of respondents got higher score in the first creative thinking skills indicator is originality (76%), it is mean the respondents were in category creative (61%-80%) [8], [14]. Furthermore, they got low and lower to the next indicator, and the lowest is elaboration, it is mean for the other indicators the respondents quite creative (41%-60%) [8], [14].

Originality here is the question about to tell one of the example in every basic chemistry content such as one of element and one of hydrocarbon compounds, there for its became easier question for the respondents. The next question is to measure fluency indicator, here respondents should to tell five example from the matter they tell in first question in every basic chemistry content, then the score got lower than before, it is can be concluded that most of respondents got difficult in this creative thinking skills indicator. Flexibility indicator is given the question about to give examples

from the first question (originality) and connect it to the real world, then the score got lower from earlier question, and it is happen in whole basic chemistry content in this research. In the last, the lowest score happen in the last indicator is elaboration, where the question is about to tell examples solution in real world that can be done by the matter which told in first question (originality).



Picture 1. Percent Score of Creative Thinking Skills

2. Basic Chemistry Contents from Chemistry Students

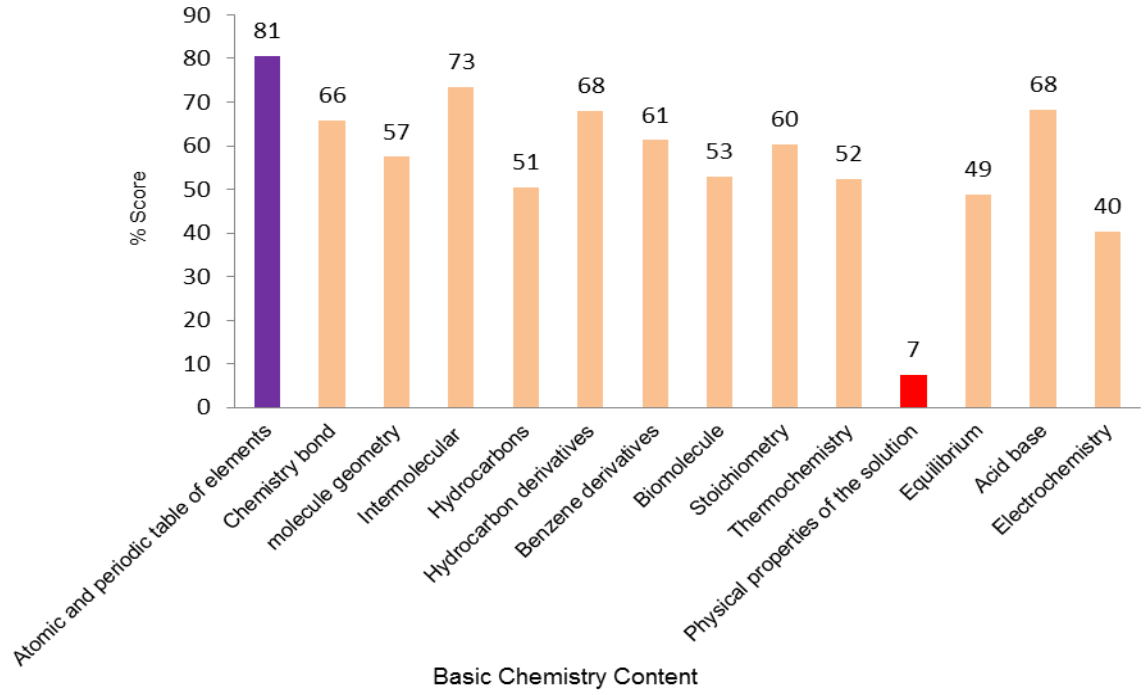
Several basic chemistry contents were evaluated in this research, to know how students have learned it in the class, even though with creative thinking skills as the tools by essay question. Student's answer showed (Picture 2) that most of them can answer clearly in the atom and periodic system of elements, also in the intermolecular the score is higher than the others with score 73%. the next concept we can conclude that just half of the students can answer the questions, can be seen from the score just between 51% until 68%.

Some contents felt difficult such as equilibrium where the score got under fifty percent (49%) and electrochemistry (40%). Electrochemistry felt difficult because it is consists of comprised concepts and has considerable importance in several applications [15], as well as equilibrium chemistry concept, which has a lot of context in real world, it also basic concept in chemistry because related to other concept such as the solubility and acid-base [16].

The lowest score got from theme of physical properties of solution. We can explain that student understand concept of atom and periodic system of elements, it is because many brilliant strategy have applied to teach and learn it, such as by games and

puzzles [17-18]. Vice versa the students did not understand clearly in concept physical properties of solution, even though this theme look like easy because not involve difficult concept, but concept of solutions involved just about memorization and mathematical calculations without attention to the sub-microscopic aspects [19].

From picture 2 we can see how large the range between score of the atom and periodic system of elements (81%) and the physical properties of solution (7%), so that it is can be attention for the lecturers to improve learning strategy in teaching basic chemistry especially in content physical properties of solution.



Picture 2. Percent score of basic chemistry content

CONCLUSION

Creative thinking skills is needed to be mastered by chemistry pre-service, because it is one of 21st century skills which need to be applied. This research can be best information for chemistry education lecturers that overall respondents in level quite creative and some of them creative, but the lecturers also to pay more attention in teaching creativity skills their students, especially for the last indicator is elaboration, it is difficult enough for students to apply it in chemistry content. Basic chemistry content also felt difficult for the students especially in the equilibrium, electrochemistry, and physical properties of solution.

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