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THE IMPACT OF ESSAY WRITING TREATMENT ON SCIENTIFIC WRITING ABILITY OF PRE-UNIVERSITY MEDICAL STUDENTS

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ABSTRACT

In normal practice, chemistry lecturer has been assessing their students' performance in the laboratory on the basis of their written reports, after the laboratory practical session. Unfortunately, this method of assessment could not improve their critical thinking as students tend to write based on what they have learnt in class without explaining what they have discovered in practical session. This is supported by Maria (2010) who emphasizes this method could not develop their analysing and evaluating skill of the experiment. This is because when students produced written reports there is no significant substance between theory and the data produced. The objective is to investigate the level of critical thinking by evaluating participants' essay based on The Holistic Critical Thinking Scoring Rubric (HCTSR), (Facione & Facione, 1994) by two experienced Chemistry lecturers. The study is based on a document analysis of 60 essays written by Foundation in Science (FIS) students at one of medical private university colleges in Malaysia. This study shows 75 % of students scored low level in critical thinking based on HCTSR rubric. Students do not appear to be able to respond critically in their writing to the information that they are exposed to and to move on to create new ideas and new perspectives. The researcher believes that this study can create the way forward to improve the mastery of scientific writing skills which could enhance students' understanding in chemistry concept.

KEYWORDS: laboratory chemistry, critical thinking, pre-university medical student, scientific writing skills

INTRODUCTION

Normally, the laboratory in the science classroom is used to involve students in concrete experiences with objects and concepts. Therefore, the need for teaching science lab is important to give students the experience to experience science activities. These experience can give valuable practical skill that students need to support

student's developing scientific literacy skill. According to Hofstein and Walberg (1995), inquiry-type laboratories are central to learning chemistry since students are involved in the process of conceiving problems and scientific questions, formulating hypotheses, designing experiments, gathering and analyzing data, and drawing conclusions about scientific problems or

phenomena. For that reason, the assessment of science lab is different with assessment in theory class. According to constructivist theories, one reason of writing laboratory reports is to bridge prior knowledge with new learning (Keys et al., 1999).

In line with the objectives and format of writing laboratory reports, some of instructors have a view that it is quite similar to scientific report. According to Beaufort (2007), writing a lab report typically follows the format of the standard scientific report. It treats genre merely as format identified by heading and sections such as introduction, experimental, data and result, discussion, conclusion and reference. Huseyin et.al (2013) also emphasize that qualified laboratory reports requires considering different issues such as theoretical background, experimental procedures, data collection, and analysis. Means that writing for science laboratory report should extend beyond the traditional records of observations and formal reports. It shows writing within disciplines is thought to require deeper analytical thinking (Langer and Applebee, 1987), which is closely aligned with critical thinking.

However, writing laboratory reports could not improve their critical thinking as students tend to write based on what they have learnt in class without explaining what they have discovered in practical session. This is supported by Maria (2010) who emphasizes this method could not develop their analysing and evaluating skill of the experiment. In conventional laboratory reports, the students are requested to complete the section such as title, purpose, procedure, data, calculations, results and discussion and are asked to verify science concepts which had already been explained to them (Mehmet et al., 2010). This situation shows that students do not really think about the relationship between science activities in the lab with the theory they have learned. As the result, the laboratory report produced are considered less scientific such as lack of clearly stated scientific aim, inadequate background, theory and context, illogical or unpersuasive presentation of data, uncertain target audience, poor organization and non-professional style and format (Peter and John, 2009) and students tend to memorize the facts and procedures (Mehmet et al., 2010).

Nevertheless, there are a few research which shows that writing task can improve student's writing ability critically. Balgopal and Wallace (2013) found that writing essay in Biological class helps students to increase their scientific literacy. According to The National Research Council (1996), scientific literacy can be describes as using scientific knowledge and evidence to draw inference necessary to make personal decisions. Furtak and Ruiz-Primo (2008) also found that the combination of writing and in-class discussion is the most effective way to assess

students in science class. Rivard and Straw (2000) similarly found that writing plus talking helps students to have higher understanding in environmental issue.

Therefore, writing essay approach in chemistry laboratory may help students' to improve their writing skills specifically in writing laboratory report critically. This means that the laboratory report produced has to achieve certain critical thinking level which is crucial in fulfilling the objective of science learning. This study paves the way for scientific writing ability of pre-university medical students through essay writing treatment in chemistry laboratory. The objective is to examine the critical thinking level among pre-university medical students through essay writing.

For pre university level of students, scientific writing ability might not be given with great emphasise as the students are yet to be exposed to thesis writing. However, assessment such as laboratory report in science practical class shows the earlier exposure to scientific writing. This is stressed by Jean and Ralph (2004) who state that laboratory report have similarities to research articles (scientific writing) in undergraduate course in the experimental sciences. Lab report follows the Introduction-Method-Results-Discussion-Conclusion format of a scientific writing closely with reflecting one of the aims of practical work.

Based on this scientific writing format, students required to elaborate, reprocess concepts and central ideas, hypothesize, interpret, synthesize and persuade and hence develop higher-order reasoning skills (Resnik and Klopfer (1989); Sutton (1992). This shows there is a strong correlation between writing task in science as it serves as the medium to produce science students with critical thinking level required. All this years, writing has been widely as a tool for communicating ideas, but less is known about how writing can improve the thinking process itself (Rivard, 1994; Klein, 2004). According to Applebee (1984), he has suggested that writing improves thinking because it requires and individual to make his or her ideas explicit and to evaluate and choose among tools necessary for effective discourse. Furthermore, Marzano (1991) suggested that writing used as a means to restructure knowledge improves higher-order thinking. Based in this context, writing may provide opportunity for students to think through arguments and use higher-order thinking skills to respond to complex problems (Marzano, 1991).

Paul (1996) defines critical thinking as a "learning how to ask and answer questions of analysis, synthesis and evaluation". This definition is supported by Brookfield (1987) maintains that critical thinking involves two interrelated processes: "identifying and challenging assumptions, and imagining and exploring other's". Critical thinking is also acknowledged as a desirable outcome in many health sciences

educational programs. The Standards for Accreditation of Medical Education Programs Leading to the M.D. Degree state that medical students should “acquire skills of critical judgment based on evidence and experience” (Liaison Committee on Medical Education, 2012, p. 7). The fact that nearly all health sciences programs recognize the importance of developing critical thinking skills is not surprising. Medical students must use critical-thinking skills to relate basic concepts to real-life situations during their pre-clinical courses. They eventually need to develop good clinical reasoning and decision making skills to provide safe and effective care to patients. Lives depend on competent clinical reasoning, and critical thinking and reflective problem solving are cognitive processes which are involved in clinical reasoning (Facione & Facione, 2008).

Zhou et al, (2013) have carried out a research to investigate the effects of task-based learning (TBL) in chemistry experiment teaching on promoting high school students' critical thinking skills in Xi'an China. For the purpose of this study, a pre-test and post-test experimental design with an experimental group (were taught with TBL) and a control group (were taught with lecturing teaching methods) were carried out. A total of 119 students aged 17-19 were voluntarily participate which lasted one semester. Five chemical experiments were selected and The California Critical Thinking Skills Test (CCTST) was used as a data collection tool. The findings provide an effective way for chemistry teachers to improve students' critical thinking analyticity skills by using Task-based learning.

Besides, pre-test and post-test were carried of 10 sections of general education biology at a regional comprehensive university in the Pacific Northwest. The outcome of this paper supports that writing group significantly improved critical thinking skills whereas the non-writing group did not. Furthermore, analysis and inference skills

increased significantly in the writing group but not the non-writing group. The author has agreed that, with improved of critical thinking skill, general education biology students will be better prepared to solve problems as engaged and productive citizens.

METHODOLOGY

Participants & Instrument

Participants included 30 students who attended Foundation in Science (FIS) which leading to medical and pharmacy program at one of medical private universities in Malaysia. Students were having 2 different experimental laboratory session and be provided with an essay respectively according to the lab manual given. Students need to complete the essay writing throughout the experimental session in analytical lab provided.

The study is based on a document analysis of 60 essays written by participants based on a standard essay prompt. This research employs *The Holistic Critical Thinking Scoring Rubric (HCTSR)*, (Facione & Facione, 1994). This instrument was chosen on the basis of it focuses on assessing evidence of critical thinking, rather than evaluating writing. In this study, two experienced chemistry lecturers were appointed as raters to evaluate each essay. Each essay was scored at least three times, with each rater was unable to see any previous score. A 'mask' was used to conceal the significance of prior raters' scores. At any juncture where the two raters disagree with each other's, a conversation between the two raters regarding their evaluations will be conducted. Discrepancies of more than one level between raters indicate that the raters must review together the evidence considered salient by each rater. This rubric is a four level scale, forced choice scale. Half point and 'middle of the two' scoring is not possible.

RESULTS & DISCUSSION

The objective of this study was to investigate the level of critical thinking by evaluating of pre-university medical students' essay based on *The Holistic Critical Thinking Scoring Rubric (HCTSR)*, (Facione & Facione, 1994).

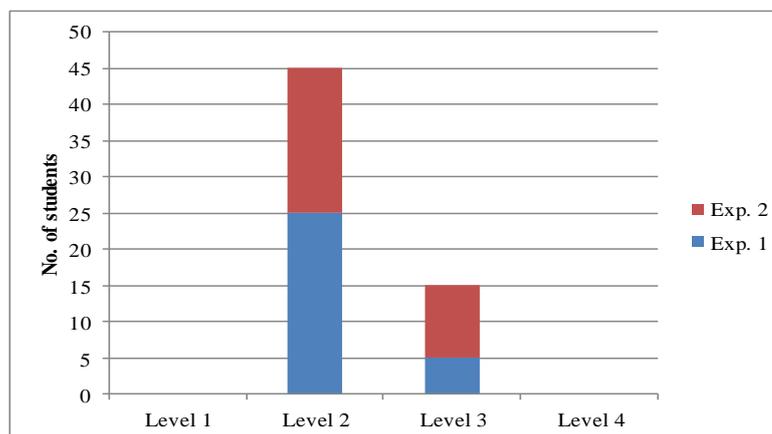


Diagram 1: Critical thinking level in essay writing among participants based on HCTSR

Diagram 1 above illustrates the critical thinking level in essay writing among participants based on the Holistic Critical Thinking Scoring Rubric.

It shows some improvement of student in performing writing an essay from first to second experiment. For the first experiment, (Decomposing Baking Soda), only 17% scored level 3 while the remaining 83% of pre-university medical students scored level 2. There are slightly improvement for the second experiment (Generating Hydrogen Gas), which student scored 33% for level 3. Earlier survey has been done and proved that a large number of our students do not appear to be able to respond critically in their writing to the information that they are exposed to and to move on to create new ideas and new perspectives. This is because, although the data shows there was an increment from 17% to 33%, the students are still at the low level as their increment only happened at level 2 and 3. Most of the student achieved level 2 due to lack of knowledge, less preparation before the experimental session start, lack of reading done, and lack of understanding of an experiment. Other contributing factors would be lack of thinking and preliminary research been done on the expected outcome of the experiment. It was found out that students rely heavily on the lab manual given and blindly follow the manual without knowing what the expected results of the experiment are. This correlates with Alaimo et. al (2009) who states students also often refer to the instructor directly in their writing without thinking critically.

Most of the students in this study share the same mistake which is misinterpret evidence and statement. As for an example, the essay prompt requires for method for calculating molar volume by experiment collecting hydrogen gas, however it was shown that most of the students only gave various methods which could collect hydrogen gas in their essay writing and disregarded the main question asked: the method which could collect hydrogen gas and could calculate its molar volume.

Alaimo et. al (2009) said that in lab, students did not draw substantially upon knowledge and did little to promote critical thinking whilst they are dealing with experiment such using standard techniques and instrumentation that may helped them master technical skill.

Most of the student did essay writing with less evidence, fails to identify strong reason and fails to identify relevant arguments (pro and con). Students tend to write what they have learned in theoretical class rather than what they are conducting in laboratory. This is because students know (or they think they know) the expected outcomes of the experiment, students tend to chalk up any deviation from the expected outcome as the “experimental error” with little thoughtful explanation. (Peter and John, 2009).

In their essay, most of the participants do not know how to sift facts from opinion, make a clear written argument or objectively review conflicting reports of a situation or event. It was discovered that there were limited instances in their essay where the respondents refers to the available evidence, evaluates the validity of that evidence, and assesses what contribution it can realistically make to the topic assigned to them. (Omar, 2014)

Students also perceive that writing is unimportant whilst according to Beaufort (2007), writing a lab report typically follows the format of the standard scientific report. Essay writing is thus crucial as it could be applied in cognitive domain. Bransford et al. 2000; Sousa, 2001 said that people learn using three domain which are cognitive, affective and behavioral. It facilitates students learning by guiding them to draw on all three domains through writing activities. As an example in academic writing essay and in essay writing for English, Omar (2014) has noted that many problems students face in writing concern not only their weaknesses in the language but, more importantly, their inability to think critically when writing, which contributes to their poor writing performance. Balgopal and Wallace (2013) also said that writing lab report is important and consider the value of helping students use writing

to explore their understanding. Writing also allows students to see what they know and revise their conception and perception.

All students who participated in our study were unable to interpret evidence accurately, analyses thoughtfully, evaluates major alternative points of view, justifies key results and procedure, explains assumptions and reasons, evaluate and synthesise arguments in a variety of sources before making any decisions; distinguish the main ideas and arguments; judge their relevance and provide reasons; judge the credibility of sources of information; and unable to draw conclusions based on all the justifications made. In addition, it was also evident that the participants were incapable to present their ideas clearly through essay writing.

CONCLUSION

This study was implemented on the basis of *The Holistic Critical Thinking Scoring Rubric (HCTSR)*, (Facione & Facione, 1990). The findings of the present study imply that more work needs to be done towards upgrading the writing treatment on scientific writing ability among pre-university medical students. Essay writing treatment in laboratory are useful which actively engage students in the investigation of information during the experimental session and the application of knowledge will promote students' critical thinking. However, pre-university medical students with any abilities, critical thinking requires training, practice and patience. For example, they eventually need to develop good reasoning and decision making skills to provide safe and effective care to patients. This study shows that pre university medical students are less critical in chemistry laboratory essay writing. The way forward for this study would be to improve the methods used in teaching Chemistry as well as it calls for efficient approach in building professional character.

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