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Augmenting scientific literacy through HOTS instruction in EFL classroom: Students' perception

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Abstract

This paper examines students' perceptions of the current practice of using Higher Order Thinking Skills (HOTS) in the classroom to enhance their scientific literacy. The study was prompted by the traditional monotonous teaching of Sociolinguistics. Pre-observation activities revealed that students found the traditional sequence of classroom movement tedious and impractical in linguistics learning. Using students' presentations and classroom discussions as a learning strategy, which are considered low-order thinking skills, resulted in students not being engaged in the discussion. However, after learning with HOTS instructions, it was found that activities such as analyzing sociolinguistics phenomena, evaluating them, and proposing ideas for further research in the field of sociolinguistics, brought new perspectives to the learning experience. The results of the questionnaires, analyzed qualitatively, showed that students had positive perceptions of learning with HOTS instructions; their scientific literacy was competently advanced, the scientific knowledge was advantageous for their social and academic interactions, and they were able to identify connections between sociolinguistics and technology. In conclusion, English as a Foreign Language (EFL) students' scientific literacy can be enhanced through this type of instruction

Keywords: *Students' Perception; Scientific Literacy; Augmenting Scientific Literacy; HOTS Instruction; EFL Classroom*

INTRODUCTION

Having scientific knowledge is crucial for an individual to understand and deal with life matters, which is why it's important to be part of an enhanced "literate society" (Al Sultan et al., 2018). The term scientific literacy supports this idea, as it represents a mastery of science that enables individuals to engage in socio-scientific topics and to understand the phenomena, practices, values, and ethics of science (Dawson & Venville, 2009). Studies on its historical background have shown that how people understand science is what scientific literacy pertains to (Deboer, 2000). As none of the domains can validly define it, scientific literacy should not be measured by tests. To determine if it has achieved its goal, we may assume that it happens when society is aware of science and its activities, which can be attained through various methods (DeBoer, 2000)

In harmony with what higher education students are expected to achieve, the results of their learning should contribute to their lives, both academically and in general. Therefore, the teaching of science must be designed in a specific way. Specifically, the course "Introduction to Sociolinguistics," which is the focus of this research, is designed to meet the students' need for this field of study.

Inadequacy in proficiency in sociolinguistics can lead to a failure to convey formality, politeness, solidarity, fellowship, and peer acceptance, which will negatively impact communication outcomes (Geeslin et al., 2018). This highlights the importance of competence in this field of study for students. The previous mode of teaching this course was found to be tedious and impractical. From pre-research observations, students were passive in classroom activities and not engaged in the lessons. Group presentations about a given topic were found to be more effective in driving classroom interaction. Question and answer sessions only prompted participation from some students, while the rest remained silent and passive. Students' passiveness is a cultural norm in Indonesia, where being submissive is common and accepted (Setyorini, 2018). Additionally, it is said to be impractical as students do not apply what they have learned in society. Empirically, students only understand and are aware of sociolinguistics phenomena.

A redesigned classroom instruction has been developed, moving from learning with lower-order thinking skills to higher-order thinking skills. The goal is to equip university students to act as change agents who are prepared to assume their participative roles as social beings (Setyorini, 2018). It has been widely documented that developing Higher Order Thinking Skills (HOTS) is crucial for a successful education and is the main objective of scientific literacy (Saido et al., 2015).

HOTS is memorizing capability and other advanced skills within a cognitive competence. As the students must deal with unfamiliar problems, hesitancy, inquiry, and predicament; these competencies can be invigorated (King et al., 2013). Driven by those rationales, the question to be investigated through the integration between frameworks of scientific literacy and higher-order thinking skills is formulated as follows.

What is the student's perception toward their scientific literacy after learning with HOTS instructions?

Scientific Literacy

Even though there is no patent on a definition of Scientific Literacy (Deboer, 2000; Roberts, 2007), experts have described this notion. Firstly, what constitutes scientific literacy is what the wider populace should be aware of (Durant, 1994). Scientific literacy is multifaceted, encompassing science concepts and thoughts, the nature of science, and the interplay of both society and science (Laugksch 2001). Meanwhile, For many years, it has been regarded as a science education goal, indicating vast and useable knowledge of the

sciences for general learning purposes rather than readiness for particular academic and professional careers (Deboer, 2000).

Furthermore, there are four aspects of scientific literacy. The first aspect is the knowledge of science. It includes the knowledge of facts, concepts, principles, laws, hypotheses, theories, and models of science. The second aspect is the investigative nature of science. It is about the ability to use methods and processes of science such as observation, measuring, classifying, inferring, recording and analyzing data, communicating using a variety of means such as writing speaking, using graphs, tables, and charts, making calculations, and experimenting. It is also about the ability to emphasize hands-on minds-on science. Moreover, the third aspect is putting science as a way of knowing. The elements are: emphasizes thinking, reason, and reflection in the construction of scientific knowledge and the work of scientist; empirical nature in science; ensuring objectivity of science; use of assumptions in science; inductive and deductive reasoning; cause and effect relationship; the relationship between evidence and proof; the role of self-examination in science; and describe how scientist experiment. The last aspect of scientific literacy is the interaction of science, technology, and society. This point considers the impact of science on society, the inter-relationship between science, society, and technology, careers, science-related social issues, personal use of science to make everyday problems, and improve one's life, as well as a science-related moral and ethical issue (BouJaoude, 2002).

Higher Order Thinking Skills in Classroom Instructions

It is widely recognized that lower-order thinking skills, such as memorizing information, differ from higher-order thinking skills. Traditionally, higher-order thinking skills align with the Bloom Taxonomy, which represents the top three levels "above comprehension." These skills involve the application of learning to enable analysis, evaluation, and synthesis, and to develop problem-solving, conclusion-drawing, measuring, inferring, summarizing, and creative thinking abilities (Wilks, 1995).

A high-level thinking skill, or HOTS, is the capacity to think rather than simply recall, restate, or regurgitate. Moreover, HOTS is capable of the following: 1) transferring one notion to another, 2) processing and applying evidence, 3) looking for connections among various pieces of information, 4) analyzing information to address issues, and 5) critically evaluating concepts and data. According to the knowledge dimension, HOTS refers not just to actual, experiential, or procedural information but also to metacognitive knowledge. The learner's capacity for conceptual connections, interpretation, problem-solving, exploration, argumentation, and judgment are all described in the cognitive processing (Supeno et al., 2019).

The theory of constructivism also emphasizes that the extensive implementation of learning is needed by the pupils so that their cognitive capability can be well-trained after developing their knowledge (Saido et al., 2015). Teachers who purposefully and habitually

implement higher-order thinking concepts, such as dealing with actual problems in class, stimulating open-ended discussions, and facilitating independent investigation experiments, obtain a useful chance of improving critical thinking abilities (Tanujaya et al., 2017).

Engaging the learners' motivation and interest and value perception while teaching is one of the easiest strategies to direct and maintain their attention. Situational interest is the term used to describe elements of your presentation that highlight actual human action or significant life issues. Engaging students' situational interest and sense of value while teaching is one of the simplest strategies to direct and maintain their attention. Situational interest is the term for elements of your presentation that focus on actual human behavior or significant life topics, as well as an emotional reaction your students actually feel (Schwartz & Bartel, 2022).

Students' Perception

The word perception refers to the act of perceiving. The definition of perception is "consciousness of anything related to background experience." Yield useful experiences of the world through the cognitive process, which serve as the foundation for real world and personality. Perception means people manage and synthesize their sensory experiences to interpret the actions in their surroundings (Robbins & Judge, 2013). Thus, students' perception is how they interpret their understandings, which affects their comprehension and gives them a helpful perspective on the outside world (Ermawati, 2020).

METHOD

This study aims to investigate students' perception of their scientific literacy after being exposed to higher-order thinking instructions (in six meetings) during classroom activities. The data are analyzed qualitatively. To comprehend the nature of the phenomenon, qualitative reports primarily include substantial data collection. Qualitative researchers must have prior experience conducting field research in which they implement collecting information in a controlled environment (Creswell, 2012).

Using a Likert scale questionnaire, the data of students' perceptions are obtained. The questionnaires are administered to 31 students, to accommodate the information needed from the course Introduction to Sociolinguistics in the EFL classroom. Taken from the 6th-semester academic year 2021-2022, the participants are the students attending Universitas Muhammadiyah Surabaya.

This instrument of data collection is elaborated by adopting the frameworks of scientific literacy (BouJaoude, 2002), which divide it into four aspects, integrated with the aspects of higher-order thinking skills. To validate the questionnaire, 8 (eight) experts are involved to conduct content validity (García de Yébenes Prous et al., 2009) by considering these items: essential; useful but not essential; and not essential (Vakili & Jahangiri, 2018). The result of the experts' panel is then statistically confirmed using the content validity ratio (CVR):

$$CVR = \frac{n_e - (N/2)}{N/2} = \frac{7 - (8/2)}{8/2} = 0.75$$

n_e represents the number of experts in the panel who have chosen "essential" for each item in the descriptor. Meanwhile, N represents all numbers of experts. The result of tabulation using the CVR formula is then compared with items of value presented in Lawshe's table. The items of a descriptor in the questionnaire are the preserved items after being valued as the results of CVR is 0.75 for 10 "essential" comments from the panel. It is higher than the minimum value (0.59) in Lawshe's table.

RESULTS AND DISCUSSION

The result of the questionnaires is summed up in percentage to show positive responses ("strongly agree" and "Agree" answers) and negative responses ("Disagree" and "Strongly Disagree" answers).

Table 1. Statements of Students' Perception toward their Scientific Literacy after Learning with HOTS Instructions

HOTS
1. The classroom activities assist me to employ the sociolinguistic knowledge
2. I pay close attention and am active in class activities
3. The learning is attractive
4. The learning is practical
SL ASPECT 1
5. I understand the key concepts of sociolinguistics
6. I understand the principles of sociolinguistics
7. I understand the theories underlying the use of language in society
SL ASPECT 2
8. I can observe the sociolinguistic phenomena
9. I can classify the sociolinguistic phenomena
10. I can analyze sociolinguistic phenomena
11. I can write reports on the results of my observation of the sociolinguistic phenomena in my society
SL ASPECT 3
12. I can find evidence of sociolinguistics in society
13. I have a tight discussion with my group members as we analyze the sociolinguistic phenomena
14. I can evaluate the sociolinguistic phenomena
15. I can elaborate examples about the use of language in the society I live with
SL ASPECT 4
16. I can assess which materials (for Introduction to Sociolinguistics course) are good to be chosen
17. I apply what I have learned in the society
18. I can inform others in society about the language use phenomena that occur

19. I can cope with social problems (related to the use of language)
20. I can establish ideas for further research (in the sociolinguistics area)
21. I am interested in having a career in the area of sociolinguistics
22. I distinguish how close the inter-relationship between language, society, and technology are

This research divides the analysis and findings into five parts. The first part presents students' perceptions in terms of higher-order thinking aspects in the classroom instructions. As shown in the table, all participants contribute positive responses toward the classroom activities, their participation, and how they are interested in the learning as well as how worthwhile the learning is. In terms of the first aspect of scientific literacy, most students gain a proficient understanding of the concept, principles, and theories of science. Moreover, the students seem to have remarkable scientific skills, even though some of them potentially are decent. Furthermore, as seen in the result of the third aspect of scientific literacy, learning with HOTS instruction contributes propitious scientific knowledge to their social and academic interactions. Eventually, students pose positive perceptions toward some aspects of scientific literacy, except on dealing with actual social problems; linkages among language, society, and technology; and having a career in the area of the science, sociolinguistics.

Fig. 1. Students' Positive Perception

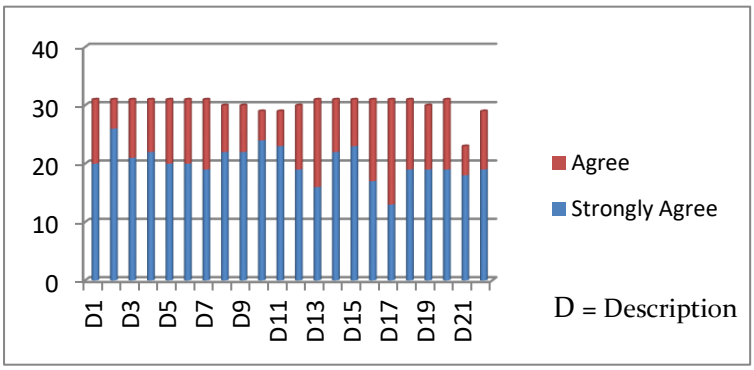

Figure 1 shows students' positive perceptions toward their scientific literacy which D1-22 are descriptions in the questionnaire. It presents how significant the positive and negative perceptions are different. We may assume that after being exposed to higher-order thinking instructions during six meetings of the Introduction to Sociolinguistics course, students' scientific literacy is satisfactorily-developed.

Sociolinguistics is broadly known as a science that studies language and its use. Yet more specifically, it is the only science that is concerned with language as a means of communication and how people utilize it in their daily businesses (Holmes, 2013; Meyerhoff, 2006). Thereunto, the topic of research within this science is particularly about

the individual, the usage of the language, and how and why it is used in different kinds of situation (Meyerhoff, 2006).

Not only educators but also English learners, whether becoming a researcher or not, should poses knowledge of language science. As a result, the learning of Sociolinguistics which was formerly considered a boring course to join should be reformed. In fact, most university lectures involve explaining or reading from a PowerPoint presentation and providing or soliciting demonstrations (Stains et al., 2018; Wieman, 2017).

The learning before reformation focuses on students' understanding of the theories of sociolinguistics. As a result, students face difficulties to settle their research on sociolinguistics. Admittedly, it is necessary to poses such lower-order thinking skills and put a "meaningful learning experience" e.g. synthesizing and evaluating, as a prominence (Garver & Roberts, 2013). Learning with higher-order thinking instructions enables students to explore their skills. Students engaged with other students in discussions as to working out the designed instructions e.g., to observe, classify, analyze, evaluate, establish new ideas in research, and solve societal problems related to language use.

Students who are educated with the application of systematic scientific literacy activities strengthen their developmental process. Referring to the results of this present study, discovers students' development of thinking processes and satisfactorily augment their scientific literacy. Not only do they pose both lower and higher-order thinking skills, but also are able to employ skills of sociolinguistic science in their lives.

CONCLUSION

Overall, teaching Introduction to Sociolinguistics (the study of language and society) using higher-order thinking skills instruction has improved students' scientific literacy. The classroom activities are structured in a way that allows students to not only achieve lower and higher-order thinking skills but also apply what they have learned (scientific literacy). Additionally, the number of passive students decreased. Ultimately, this study provides opportunities for further research on the scientific literacy of lecturers or teachers.

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