The Relationship of Ethnochemistry Learning Experience with Students Scientific Attitudes based on Gender Perspective

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Abstract-This study aims to analyze the relationship between the ethnochemistry learning experience and students' scientific attitudes from a gender perspective. This quantitative research adopted a survey design. It involved 60 chemistry education students (40 female and 20 male) as the research samples and was determined through the cluster random sampling technique. The data collection instrument adopted the CAEQ questionnaire. The collected data were then analyzed by multiple regression test at a significance level of 0.05. The results presented: 1) The scientific attitude of prospective chemistry teachers was higher than the ethnochemistry-based learning experience; 2) there was a significant relationship between the ethnochemistry learning experience with the scientific attitude of students from a gender perspective

Index Terms- ethnochemistry, learning experience, student's scientific attitudes, gender

I. INTRODUCTION

Chemistry learning in higher education refers to 3 main domains: cognitive, affective, and psychomotor. These aspects align with 21st-century learning objectives in the era of the industrial revolution 4.0. The 21st-century skills components cover critical thinking, communication & collaboration, problem-solving, creative thinking, and scientific attitudes (Syafrial et al., 2022; Wahyudiati, 2022). Concerning scientific attitudes, this is individual behavior that tends to solve everyday life problems through the scientific method to enhance soft skills development (Wahyudiati et al., 2019). Implementing a scientific attitude to achieve chemistry learning objectives is essential. However, its current practice focuses on mastering concepts rather than developing scientific attitudes and psychomotor aspects. It creates students' poor scientific attitudes and lack of problem-solving skills (Patonah et al., 2021; Sutrisno et al., 2020).

Scientific attitude indicators include self-efficacy, attitudes toward chemistry, and learning experiences (Dalgety et al., 2003). These three indicators influence each other. The higher attitudes toward chemistry, the higher it will impact on increasing student self-efficacy and learning experiences, and vice versa. Still, research studies that examine these three aspects are limited and concerned more with attitudes toward science (Çalik et al., 2015). It is scarce to measure the chemistry education students' scientific attitudes (Wahyudiati, 2021b; Zhou et al., 2019).

Moreover, the factual conditions of chemistry learning in Indonesian universities portray that learning concentrated on mastering concepts rather than developing attitudes, skills, or experimental activities, and they use an unvaried learning approach (Irwanto et al., 2021; Wahyudiati, 2022; Yustina et al., 2022). Therefore, more research is expected to measure chemistry students' scientific attitudes in Indonesian universities by utilizing innovative technology and learning strategies that significantly affect the students' scientific attitudes' improvement (Osborne et al., 2003; Zhao & Wang, 2022). The quality of chemistry learning requires various innovative strategies in teaching and must be balanced with improving the lecturers' quality so that students' learning experience becomes more comprehensive.

The students learning experience will determine their learning outcomes. Its realization is by encouraging them to independently construct knowledge, skills, and scientific attitudes (Sumardi et al., 2020; Sutrisno et al., 2020; Syafrial et al., 2022; Wahyudiati, 2021a). Yet, previous research showed that classroom learning tends to take place in one direction and is dominated by lecturers, which limits students' soft and hard skills (Fadli & Irwanto, 2020; Patonah et al., 2021). Thus, the learning experience is one of the critical factors influencing the achievement of chemistry learning objectives in universities.

A learning experience is vital for growing students' knowledge, attitudes, and skills. Significant learning experience could generate qualified and competent graduates in the job market qualifications. Through learning experiences—problem-solving activities, it trains students to solve a problem through scientific procedures (Edelson, 2001; Fadli & Irwanto, 2020; Patonah et al., 2021; Wahyudiati, 2022; Wahyudiati et al., 2019). In addition, to help students' concepts understanding could be through habituation of learning experiences relevant to their daily life experiences or known as local wisdom. The integration of chemistry learning with students' local wisdom is the implementation of contextual learning by combining chemistry with culture, known as the ethnochemistry approach (Sutrisno et al., 2020; Wahyudiati, 2021a). Applying the ethnochemistry approach in learning could help students formulate research problems and hypotheses and prove hypotheses so that the expected chemistry learning objectives can be accomplished optimally (Suardana et al., 2018; Wahyudiati et al., 2020). Then again, research studies that examined ethnochemistry-based learning experiences are still inadequate and more focused on cognitive learning outcomes (Dewi et al., 2017; Osborne et al., 2003).

Contextual learning experiences could develop students' scientific attitudes because of the active involvement of students in constructing knowledge and skills independently. Providing contextual learning experiences such as ethnochemistry-based learning is one solution to improve students' scientific attitudes.

However, its implementation in universities is still rare (Dewi et al., 2017; Osborne et al., 2003; Wahyudiati & Fitriani, 2021). Besides the approach and learning environment factors, various research results proved that there is a relevance between learning experiences and scientific attitudes based on gender and also between learning experiences and critical thinking skills based on grades level (Dewi et al., 2017; Osborne et al., 2003; Xu et al., 2013; Zhao & Wang, 2022). However, there has never been a study regarding the relevance of ethnochemistry-based learning experiences with scientific attitudes from a gender perspective. Therefore, research that points out the relationship between the ethnochemistry learning experience and students' scientific attitudes from a gender perspective is highly encouraged.

II. METHOD

This quantitative survey study employed a cross-sectional survey design. A cross-sectional survey design measures the This quantitative research used a cross-sectional survey design to obtain quantitative data and a focus group interview technique to confirm the data. The purpose of using a cross-sectional survey design was to measure the relationship between two or more variables in describing factual conditions (Creswell & Creswell, 2017). The research sample was determined through a cluster random sampling technique in the department of chemistry education at the Mataram State Islamic University, consisting of 60 students (40 female and 20 male).

The data were collected through surveys and interviews. The ethnochemistry-based scientific attitude and learning experience instrument adopted a CAEQ or chemistry attitudes and experiences questionnaire (Coll et al., 2002), which was transformed into an ethnochemistry-based CAEQ instrument. The instrument was tested by employing expert and empirical validation to measure the instrument's reliability level. Cronbach's alpha coefficient value was obtained at = .82 > .70 and was declared reliable (Hair et al., 2010). Finally, the data were analyzed using multiple regression analysis to determine the relationship between students' scientific attitudes and ethnochemistry-based learning experiences.

III. FINDINGS & DISCUSSIONS

The average value of chemistry education students' scientific attitudes (SI) and ethnochemistry-based learning practices (PBE) based on gender was determined based on the average score and standard deviation shown in Table 1. The mean of PBE was 80.40, while the mean value of SI was 85.30 (see Table 1)

Table 1. Mean SI and PBE value of Chemistry education student

Measured aspect	N	Mean	SD
PBE	60	80.40	4.90
SI	60	85.30	4.32

Before testing the hypothesis, a prerequisite test was performed through the normality and homogeneity tests. The results showed that the data were homogeneous and normally distributed because the p-value was higher than 0.05. The test continued with multiple regression tests and hypothesis testing. It indicated a significant relationship between SI and PBE for chemistry education students based on gender because the p-value was higher than 0.05, which means that the alternative hypothesis was accepted and the null hypothesis was rejected (Table 2).

Table 2. Regression analysis test of ELE and CTS based on gender

Test	**df**	**F**	**Sig**
Regression	2	.958	.000

The average value of the ethnochemistry-based learning experience for chemistry education students (80.40) tends to be lower than their average scientific attitude (85.30). The average value of students' scientific attitude skills, including the high category (85.30), indicates that chemistry's problem-based and contextual learning experience positively impacts scientific attitudes. It is because, in learning activities, the lecturer applies a learning model that refers to problem-solving to understand concepts and develop students' scientific skills (Hair et al., 2010; Sutrisno et al., 2020; Syafrial et al., 2022). This condition supported that instilling students in learning activities to be taught using innovative learning models based on problem-solving is highly expected (Tan & Gilbert, 2014; Villafañe & Lewis, 2016; Wahyudiati, 2021b, 2022).

The development of students' positive attitudes toward chemistry learning is influenced by the development of scientific attitudes and the ethnochemistry-based learning experience. Ethnochemistry-based learning initiates students to be actively involved in constructing knowledge independently (Rahmawati, 2018; Sutrisno et al., 2020). The results of previous studies showed that the female students' scientific attitude tends to be higher than that of male students because female students have more positive interest, persistence, curiosity, and chemical attitude than male students (Villafañe et al., 2014; Villafañe & Lewis, 2016).

The current research proved a significant relationship between ethnochemistry-based learning experiences and students' scientific attitudes based on gender. The implementation of ethnochemistry in learning is reflected in integrating chemical concepts with students' daily lives, both in the form of local wisdom values and the resulting cultural products. Likewise, Rahmawati (2018) and Singh (2016) believed that integrating culture into learning will help students relate the subject matter to everyday life, and that would provide a more interesting and significant learning experience. In addition, ethnochemistry could increase male and female students' interest and learning motivation by integrating chemical concepts relevant to cultural traditions (Tan & Gilbert, 2014; Villafañe & Lewis, 2016; Wahyudiati, 2022). In the application of ethnochemistry, students' involvement in actively constructing knowledge relevant to everyday life, which is part of their culture, is believed to increase a sense of nationalism and love for their culture (Sumardi & Wahyudiati, 2021).

Ethnochemistry-based learning experiences and students' scientific attitudes positively correlate with learning outcomes. Ethnochemistry-based learning experiences enable students to be actively involved in constructing knowledge to improve chemistry education students' scientific attitudes and cognitive learning (Sumardi & Wahyudiati, 2021; Villafañe et al., 2014; Wahyudiati, 2021b; Zhao & Wang, 2022). Thus, applying approaches or

learning models that prioritize problem-solving activities based on local wisdom is crucial to creating a more significant chemistry learning experience. Therefore, educational institutions should facilitate lecturers to design and implement chemistry learning with innovative and ethnochemistry-based learning models.

IV. CONCLUSION

Based on the study's results, it can be concluded: 1) The chemistry education students' scientific attitude was higher than the ethnochemistry-based learning experience, and 2) there was a significant relationship between the ethnochemistry learning experience and the scientific attitude of students in terms of gender perspective.

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