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Implementation of the Inquiry Learning Model Integrated Ethno-STEM for Secondary Metabolites on the Concept Mastery and Conservation Characteristics of Students

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Abstract. The purpose of this research is to determine the effect of the Implementation of the Inquiry Learning Model Integrated Ethno-STEM for Secondary Metabolites on the Concept Mastery and Conservation Characteristics of Students. This research is part of the Basic Research of Higher Education Excellence in 2022. The research begins in 2021 by (1) developing an ethno-STEM integrated inquiry learning model with the Sudarmin syntax through the define, design, and development stages, (2) the preparation of research instruments for mastering chemical concepts organic and conservation characters which are further validated. In this research, the application of an evaluation tool for mastery of conservation concepts and characters assisted by the google form application after learning with the Ethno-STEM integrated inquiry learning model that has been produced. The research subjects are students of chemistry education at the Faculty of Mathematics and Science (FMIPA) of Universitas Negeri Semarang for the 2021/2022 academic year. At the end of the implementation of the Ethno-STEM Integrated Inquiry learning model with the Sudarmin syntax the data were analyzed. The results of the research concluded (a) Students' concept mastery scores still need to be improved, because based on N-gain scores there are still many moderate categories, (b) understanding of the conservation character of students regarding secondary metabolites from Indonesian tropical forest plants and their benefits in achieving good categories, (c)) The overall results of the learning activities show a positive response to the model that has been developed.

Key words: Inquiry Learning Model, Ethno-STEM, Conservation

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INTRODUCTION

This research is important, because at this time the conservation character in the academic community is the realization of the vision and mission of Universitas Negeri Semarang as a conservation-minded university with international reputation (UNNES, 2019). Thus, this research is a form of contribution to the realization of the vision and mission of the UNNES as a conservation-minded university with an international reputation. Therefore, an innovative learning model that is able to realize the conservation character of students is important to find and develop, and one of them is the Ethno-STEM integrated inquiry learning model. The inquiry learning model is a learning model that is able to develop students' thinking skills, mastery of concepts, and students' scientific character and attitude (Wening, 2011, Damayanti et al, 2017, Sudarmin et al, 2021, Sumarni W, et al, 2021)).

Research as part of superior basic research in higher education with the title of Ethno-STEM integrated inquiry learning model design, secondary metabolite bioactivity study material to accelerate student conservation character. Thus, the purpose of this research is to analyze the mastery of students' mastery of conservation concepts and characters. This research has been started in 2021 by (1) developing an ethno-STEM integrated inquiry learning model with the Sudarmin syntax through the define, design, and development stages, (2) preparing research instruments for mastering organic chemistry concepts and conservation characters which will then be validated. This research is important to do, because the results of the analysis on the mastery of the concept of secondary metabolites in students and conservation characters still need to be developed and improved.

In this study, solutions were applied to improve conceptual mastery and provision of conservation characters through the application of previous research outputs related to the Ethno-

STEM integrated inquiry learning model with the *Sudarmin* syntax (Sudarmin et al, 2022). This research is interdisipliner with purpose apply the Ethno-STEM integrated inquiry learning model and how it affects students' mastery of concepts and conservation characters. This research also analyzes student responses to the learning that has been done. In this research, data collection on the mastery of conservation concepts and characters was carried out with the help of the Google Form application, because during the implementation of this research, the COVID-19 pandemic outbreak had not disappeared.

The application of learning with the Ethno-STEM integrated inquiry learning model is carried out on research subjects of chemical education students of the Faculty of Mathematics and Natural Sciences (FMIPA) Universitas Negeri Semarang for the 2021/2022 academic year. At the end of the application of the Ethno-STEM integrated inquiry learning model with the Sudarmin syntax, a test of mastery of chemical concepts and conservation characters was given, the data on the mastery of conservation concept and character test data obtained were analyzed for the student's test scores and conservation character. In this research, the character of conservation is analyzed by analyzing the response data and knowledge of the conservation character of the students. At the end of the application of the Ethno-STEM integrated inquiry learning model, focus group discussion (FGD) activities were carried out for improvement, continued by disseminating research results, so that valid and feasible ethno-STEM integrated inquiry learning tools were produced. The success of this research will be beneficial for the development of science, technology, as well as for the community to gain knowledge about the health benefits of tropical forest plants.

RESEARCH METHOD

This research has been started in 2021 by (1) developing an ethno-STEM integrated inquiry learning model with the Sudarmin syntax through the define, design, and development stages, (2) preparing research instruments for mastering the concept of organic chemistry (secondary metabolites) and conservation characters which will then be validated. In this research, the application of the ethno-STEM integrated inquiry learning model with the *Sudarmin* syntax and its effect on the mastery of the secondary metabolite concept and conservation character of students.

The subjects of this study were students of chemistry education at the Faculty of Mathematics and Natural Sciences (FMIPA) UNNES with a total of 32 students for the 2021/2022 academic year. The implementation of the integrated inquiry learning model of Sudarmin's ethno-STEM syntax was carried out in eight meetings. At the beginning and end of the implementation of the Ethno-STEM integrated inquiry learning model, students' mastery of concepts and character conservation tests were conducted and the scores were analyzed by N-gain and qualitative descriptions. In the research, the data in the form of mastery scores of the secondary metabolite concept, the scores of the inquiry reports on isolation, maceration, phytochemical tests, antioxidant, antibacterial, and anticancer tests obtained were analyzed, so that the level of achievement of scientific work scores and the value of the experimental reports were known

RESULTS AND DISCUSSION

Design Results of Ethno-STEM Integrated Inquiry Learning Models and Implemention

The implementation of the *Sudarmin* Integrated Ethno-STEM Inquiry learning activity was designed through online learning by applying the zoom application for study materials regarding (a) the nature of inquiry learning in the Wenning model and its syntax, (b) the diversity of secondary metabolites, health benefits and characteristics, (c)) analysis of articles related to the content of secondary metabolites from tropical forest plants and their bioactivity (Sudarmin et al, 2020, 2021).

While offline activities, the students conducted experiments on the extraction and maceration of the main components of Bajakah herbal tea, yellow root, ant nest, and yellow root with organic solvents. Student practicum experiments in groups regarding phytochemical tests, anticancer bioactivity, and antioxidants by applying interactive demonstrative inquiry. In general, the activities of implementing Ethno-STEM integrated inquiry learning activities in this research refer to Wenning (2011) and Kidman, G (2017). The characteristics of the inquiry learning model applied in this research designed are presented in Figure 1.

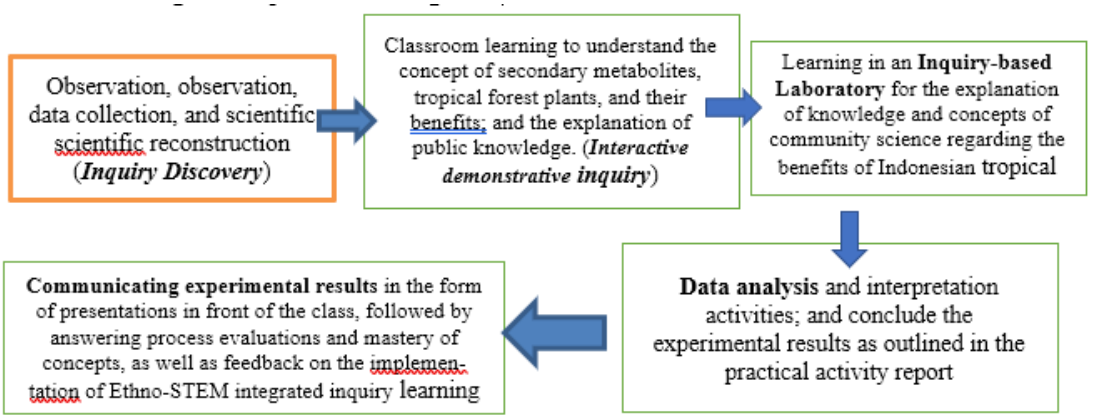

Figure 1. Stages of learning implementation Integrated Ethn-STEM

Ethno-STEM Integrated Inquiry Learning Activities, the topic of bioactivity study of tropical forest plant secondary metabolites is presented in Figure 2.

Figure 2. Photo evidence of the implementation of Ethno-STEM integrated inquiry learning activities in the laboratory.

In this research was carried out in eight meetings according to the schedule for the Natural Materials Chemistry lecture. While the meeting activities in inquiry learning in this research are presented as follows:

Table 1. Activities for implementing Ethno-STEM Integrated Inquiry Learning with the *Sudarmin* syntax.

No	Lecture Meeting	Lecture Topic	Learning Outcomes
01	First and Second	Inquiry learning model, STEM, Ethnoscience, Ethno-STEM, Recons-truction of scientific science	Understand, apply, and analyze the meaning and nature of Inquiry learning models, STEM, Ethnoscience, Ethno-STEM, Recons truction of scientific
02.	Third to eighth meeting	Diversity of secondary meta bolites (Terpenoids, steroids, flavonoids, alkaloids, and phenyl propanoids). Inquiry practicum isolation, extraction of phytochemical, antioxidant, antibacterial, and anticancer tests.	Understand, analyze the diversity of secondary metabolites, as well as skilled in conducting inquiry practicum Isolation, extraction of phytochemical, antioxidant, antibacterial, and anticancer tests.
03	Ninth meeting	Data collection of students' mastery of conservation concepts and characters	Data on the mastery of students' conservation concepts and characters..

The effect of implementing MPI Integrated Ethno-STEM on concept mastery. In this research, an analysis of the influence of the application of the Ethno-STEM Integrated Inquiry Learning Model on the Mastery of Conservation Concepts and Characters was carried out. The results of the concept mastery data analysis, after analyzing the pretest and posttest scores are presented in Table 2.

Table 2. Results of Concept Mastery Recap After Learning Integrated Ethno-STEM Inquiry with Sudarmin's syntax.

No	Score Level N-gain	Amount (person)	Score category N-gain	Percentage (%)
01.	0.71 – 1.00	4	high	0,13
02.	0.41 - 0.70	19	medium	0.59
03.	0.00- 1.40	9	low	0.28

The results of this research show that the implementation of the Ethno-STEM integrated inquiry learning with the Sudarmin syntax has been effective and is able to significantly improve learning achievement. In this research, the results of laboratory inquiry work were also assessed for isolation and extraction practicums, phytochemical tests, antibacterial tests, and anticancer tests, then each group compiled a practicum report and the results of the assessment were presented in Table 3.

Table 3. Assessment of the Secondary Metabolite Bioactivity Inquiry Report Practicum

No	Student Group	Practice activity scores (Responsibility, curiosity, discipline, and scientific attitude)	Practice report scores	achievement category
01	The first	This group's responsibility, scientific attitude, curiosity, and scientific attitude are in the very good category	91	Very good
02	Second	This group's responsibility, curiosity, and scientific attitude to the achievement is very good, while the discipline is good.	90	Very good
03	Third	This group's curiosity and scientific attitude on achievement is good, while for responsibility and discipline it is very good	88	Good
04	Fourth	This group's responsibility, scientific attitude, curiosity, and scientific attitude are in the very good category	92	Very good
05	Fifth	This group's curiosity and scientific attitude towards achievement is very good, while responsibility and discipline are good.	88	Good

Response to the Implementation of Ethno-STEM Integrated Inquiry Learning

Student responses after learning are known to students (a) have understood the meaning of ethnoscience (96.50%), (b) have known the inquiry model (84.20%). (c) understand the syntax of the inquiry model (73.70%), (d) recognize the STEM approach (78.90%), (e) understand the syntax of integrated inquiry learning ethno-STEM (84.20%), (f) know and know tropical forest plants (98.20%), (g) understand the characteristics of tropical forest plants (86%), (h) understand the health benefits of some tropical forest plants (96.50%), (i) feel interested in the ethno-STEM integrated inquiry learning model lecture (94.70%). Based on the results of student responses, the ethno-Stem integrated inquiry learning model received a positive response from students.

CONCLUSION

The results of the study concluded (a) The value of students' concept mastery still needs to be improved, because based on the N-gain value there are still many moderate categories, (b) students' understanding of conservation character about secondary education of Indonesian tropical forest plant metabolites and their benefits in achieving good category, (c) Overall, the results of the learning activities showed a positive response to the developed model. It is written in one paragraph without numbering. Answering the research objectives.

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