

# Assessment of Practical and Scientific Writing Skills for Pre-University Students through Project-Based Learning

Wan Roslina Wan Yusof,\* Melody Kimi, Wan Sharifatun Handayani Wan Zullkiplee, Mohd Alhafizh Zailani, Mardhiah Shahabudin, Abdul Al-Hafiz Ismail, Sharifah Mona Abd. Aziz Abdullah, Iswan Nur Ariff Ismail, and Dhana Jay Raja Gopal



Cite This: <https://doi.org/10.1021/acs.jchemed.1c00843>



Read Online

ACCESS |



Metrics & More



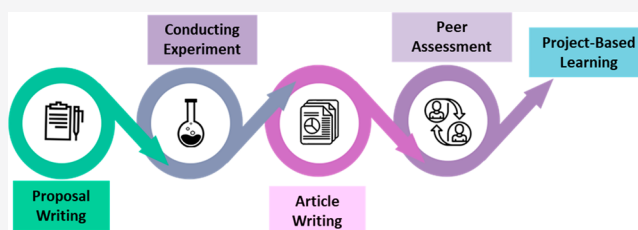
Article Recommendations



Supporting Information

**ABSTRACT:** Chemistry is one of the STEM (science, technology, engineering, and mathematics) subjects that has been perceived as an unattractive subject among students due to its scientific theories and practices in a laboratory. Practical and scientific writing skills are two crucial components in chemistry courses, including at the Pre-University level, thus requiring educators to design activities that integrate both skills in chemistry learning. This article describes the assessment using a project-based learning approach to assess students' practical and scientific writing skills for the Organic Chemistry course at the Universiti Malaysia Sarawak Foundation in Science program. A total of 72 Pre-University science students participated in a Chemistry Group Project assessment. The students were divided into 6 groups and asked to write a proposal on the basis of a chosen title, conduct laboratory work, collect data, and prepare a final report. The assessment was conducted in a single semester from learning week 1 to learning week 17. Results of this study were collected through the submitted proposal, final reports, practical sessions, and students' feedback. Students obtained good marks for practical and scientific writing with average marks of 84.9% and 84.4%, respectively. The results revealed that implementing the Chemistry Group Project as project-based learning leads to increased performance in practical and scientific writing skills and social skills among Pre-University students. Therefore, the Chemistry Group Project should be conducted as one of the learning activities and practical approaches at the Pre-University level.

**KEYWORDS:** High School/Introductory Chemistry, Laboratory Instruction, Organic Chemistry, Collaborative/Cooperative Learning, Inquiry-Based/Discovery Learning, Student-Centered Learning, Applications of Chemistry



## INTRODUCTION

Science, technology, engineering, and mathematics (STEM) education has been regarded as one of the central topics in the educational field, highlighting problem-solving with real-life problems.<sup>1</sup> Furthermore, one of the objectives of 21st-century learning is for students to achieve 4C, which are communication, collaboration, critical thinking, and creativity, in their STEM learning.<sup>2</sup> Like other countries around the world, Malaysia also focuses on the strategies to strengthen STEM education among students as outlined in the Malaysia Education Blueprint 2013–2015 to meet the Industry 4.0 demands.<sup>3</sup> In Malaysia, Pre-University science students are exposed to advanced STEM subjects, which are almost similar to the First Year Degree Programs.<sup>4</sup>

Chemistry, one of the STEM subjects, has been perceived as a difficult subject among students.<sup>5</sup> Moreover, students' lack of interest and motivation toward STEM topics, mainly in organic chemistry, has become a problem in strengthening STEM education.<sup>1</sup> The problem arises because organic chemistry focuses on functional groups and simple reactions of organic compounds.<sup>6</sup> In addition, the topic is loaded with specific

concepts, facts, reactions, formula, and technical language in the learning process.<sup>5,6</sup> Besides, the symbolic representations used in chemistry make the subject more complicated for the students.<sup>7</sup> Learning chemistry theories and concepts in the lecture hall per say is insufficient to increase students' capabilities to achieve 4C in their STEM learning, so the theories must be supported by practical and hands-on activities.<sup>8</sup> On another note, scientific writing skills are also crucial in STEM learning activities, specifically in chemistry at the Pre-University level. Scientific writing is essential to construct and convey scientific knowledge to readers.<sup>9</sup> Written explanations require students to relate the new information

Received: August 4, 2021

Revised: December 14, 2021