

# Factors Influencing the Students without Fundamental of Chemistry to Study General Chemistry Course

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## ABSTRACT

Students' intake of September 2022 shows some enrolled in Diploma in Science program at UiTM Sabah Branch have no background in the core courses. The Malaysian Ministry of Education has announced the implementation of the Standard Secondary School Curriculum (Upper Secondary) and the introduction of subject packages, effective from 2020. Consequently, students opting for the STEM package are tend to favor the third criterion, which is less challenging as it excludes the study of any pure science subjects. Hence, a scientific workshop program was conducted to enhance student performance specifically in general chemistry course, particularly those without a prior background in chemistry. Consequently, the purpose of this study is to identify the factors influencing the students' intention to study General Chemistry course through the scientific workshop. The workshop took place as a preparatory session before test. Surveys were administered to the students via a Google Form at the end of the workshop. A total number of 49 respondents out of 61 have completed the survey. Their feedback shows that their intention to study the General Chemistry course were influenced by their confidence levels and understanding. While not all respondents (65%) expressed agreement regarding the overall effectiveness of the workshop on their academic performance, every respondent agreed that the workshop should be conducted again as preparation for the next test.

**Keywords:** Diploma in Science, science background, STEM package, workshop, effectiveness

## INTRODUCTION

The Ministry of Education Malaysia (MOE) has introduced the Standard Secondary School Curriculum (Upper Secondary) and subject packages in all secondary schools, including special education and new subjects, starting in 2020. The upper secondary subject package is in line with the Malaysia Education Blueprint 2013-2025 and MOE desires to ensure that more upper secondary students can make appropriate subject package choices based on their preferences, interests, and abilities, as well as provide added value to meet eligibility requirements for the Matriculation Program, Form Six level, higher education institutions, or career fields. There are two packages offered: the STEM Package and the Arts and Humanities Package.

According to MOE Professional Circular Letter No. 6/2019, the STEM A package allows interested and qualified students to continue their studies at the foundation program, Matriculation Program, and Form Six level in science, medicine and health, engineering, biotechnology, and others. The STEM B package gives students guidance and chances to pursue higher education and careers in technology-related sectors like computer science, engineering, design, manufacturing technology, accounting, and others. The STEM C package offers students the chance to pursue further education at certificate and diploma levels in public universities, polytechnics, community colleges, and skills institutions. The STEM C package exclude the

study of any pure science subject. The focus is on career paths such as business, fashion design, hospitality, and media design (new media design). Table 1 shows the STEM C package which exhibits a combination of at least two STEM electives in applied science and technology or one vocational subject (*Kementerian Pendidikan Malaysia*, 2019).

Table 1: STEM C, Ministry of Education Malaysia (2019)

<b>EXAMPLE 1</b>		
<b>Core</b>	<b>Compulsory</b>	<b>Elective</b>
<ul style="list-style-type: none"> <li>• Bahasa Melayu</li> <li>• English</li> <li>• Mathematics</li> <li>• Science</li> <li>• History</li> <li>• Islamic Studies/ Moral Education</li> </ul>	<ul style="list-style-type: none"> <li>• Physical and Health Education</li> </ul>	<ul style="list-style-type: none"> <li>• Computer Science</li> <li>• Design</li> <li>• Visual Arts Education</li> </ul>
<b>EXAMPLE 2</b>		
<b>Core</b>	<b>Compulsory</b>	<b>Elective</b>
<ul style="list-style-type: none"> <li>• Bahasa Melayu</li> <li>• English</li> <li>• Mathematics</li> <li>• Science</li> <li>• History</li> <li>• Islamic Studies/ Moral Education</li> </ul>	<ul style="list-style-type: none"> <li>• Physical and Health Education</li> </ul>	<ul style="list-style-type: none"> <li>• Additional Science</li> <li>• Additional Mathematics</li> <li>• Technical Graphics Communication</li> </ul>
<b>EXAMPLE 3</b>		
<b>Core</b>	<b>Compulsory</b>	<b>Elective</b>
<ul style="list-style-type: none"> <li>• Bahasa Melayu</li> <li>• English</li> <li>• Mathematics</li> <li>• Science</li> <li>• History</li> <li>• Islamic Studies/ Moral Education</li> </ul>	<ul style="list-style-type: none"> <li>• Physical and Health Education</li> </ul>	<ul style="list-style-type: none"> <li>• Signage Design and Production</li> </ul>

Aligned with the implementation of the Standard Secondary School Curriculum (Upper Secondary) and subject package choices in Sijil Pelajaran Malaysia (SPM), the entry requirements for admission to UiTM academic programs, particularly the Diploma in Science have changed.

Table 2 illustrates how the program requirements changed starting from Academic Session 1 2022/2023, intake September 2022. Previously, to enroll in the program, the students needed to be in a science stream earn at least two credits, and pass in the pure science subjects of physics, chemistry, and biology. Starting from the intake of September 2022, where the requirements were reviewed for admission to the program, students can earn credit in any one subject of STEM elective from pure science, applied science and

technology, or vocational areas. As a result, some students enrolled in the Diploma in Science program at UiTM Sabah Branch, Kota Kinabalu Campus, have no background in the core courses such as chemistry, physics, and biology as they have the option to use their results in any science and technology or vocational areas to enrol in the program.

Table 2: Entry requirements for admission to Diploma in Science, UiTM (2021)

<p><b>General university requirements before the Academic Session 1 2022/2023:</b></p> <p>Pass SPM with minimum 5 credit (grade C and above), including Bahasa Melayu and pass History</p>	<p><b>General university requirements for the Academic Session 1 2022/2023 onwards:</b></p> <p>Pass SPM with minimum 3 credit (grade C and above), including Bahasa Melayu and pass History</p>
<p><b>Program requirements for SPM holders:</b></p> <p>Pass the general university requirements with credits in:</p> <p>Mathematics or Additional Mathematics</p> <p><b>And</b></p> <p>2 credits and 1 pass in the following subjects:</p> <ul style="list-style-type: none"> <li>• Physics</li> <li>• Chemistry</li> <li>• Biology</li> </ul> <p><b>And</b></p> <p>Pass English</p>	<p><b>Program requirements for SPM holders:</b></p> <p>Pass the general university requirements with credits in:</p> <ul style="list-style-type: none"> <li>• Mathematics or Additional Mathematics</li> <li>• English</li> <li>• Biology / Physics / Chemistry / Science / Additional Science / Home Science / Agriculture / Design / Sport Science / Mechanical Engineering Studies / Electrical &amp; Electronics Engineering Studies / Aquaculture &amp; Recreational Pets / Domestic electrical equipment repair / Landscape &amp; Nursery / Business / Entrepreneurship Studies</li> </ul>

Modifying the requirements for enrolment in the Diploma in Science to waive the demand for pure science courses like physics, biology, and chemistry may have effects on students' understanding and foundational knowledge in the core courses. Chemistry is one of the core courses for the program. Students enrolling in the program must complete chemistry courses ranging from fundamental to more advanced during the semester in which they are pursuing their diploma. In semester 1, the students must enrol in General Chemistry, a course designed to equip them with the fundamentals of chemistry. Topics such as the nomenclature of compounds, atomic structure, chemical bonding, and stoichiometry that are covered in this course are fundamental to the learning of more advanced concepts within the discipline of chemistry and other science concepts in biology and physics (François et al., 2023). Unfortunately, students who have a limited previous background in chemistry may find the course challenging to comprehend and may struggle to learn the fundamental ideas and terminology associated with the course. Consequently, their confidence

level in studying the course may be lower than that of students who have taken the course before. Students with low confidence levels in studying general chemistry may face challenges as they progress to more advanced chemistry courses. According to Ealy (2018), conceptual challenges in organic chemistry were caused by a lack of understanding of general chemistry concepts.

A range of studies have explored the impact of workshops on students' confidence levels. (Briscoe et al., 2023) found that a workshop on academic resilience increased students' confidence in engaging with feedback. Similarly, (Rizzi et al., 2020) reported that a creative workshop enhanced self-confidence and trust among adolescents. Ahmad (2021) highlighted that a positive self-confidence leads to optimism and energizes a person to believe in his abilities regardless of the challenges of the task. Yudho et al. (2022) further demonstrated the positive effect of self-confidence reinforcement on students' cognitive abilities in following the learning process. Fridrict et al., (2023) in their study found that the higher the confidence in learning the subject improves the students' intention to study the subject. These studies collectively suggest that workshops can be effective in boosting students' confidence, with potential benefits for their academic performance.

Several research studies have shown that workshops have a beneficial effect on students' understanding. Fu and Gao (2020) found that workshops significantly improved college students' thinking traits, particularly in teamwork and visualization. Similarly, Ramdani et al., (2022) reported that workshops led to changes in student-teachers' beliefs. Jepsen, Toxvig and Nielsen (2021) used a workshop to teach epistemology to healthcare students, with students reporting a better understanding of the subject. Dahal and Pangenji (2019) highlighted the active learning in workshops engaging students in learning, developing higher-order skills and peer assessment. These studies mutually suggest that workshops can enhance student understanding in various fields.

Previous research suggests that workshops can be effective in improving student academic performance. Salvado et al., (2021) reported that students see science careers as hard, demanding, and low reward. However, scientific workshop improves science identity, science capital and educational aspiration of students. A scientific workshop provides students with a more realistic view of what they are studying in science. Fung and liang (2018) found that group work, a common workshop activity, can enhance critical thinking skills and academic performance. Bohanon et al., (2020) further emphasized the importance of active learning in workshops increasing student engagement, a key factor in academic success. Strietzel et al., (2020) found that workshop increased participants' competency, suggesting a positive influence on academic performance. Fernández-García et al., (2021) identified active learning is a key factor in student engagement, which can be influenced by workshop content. Ahmad (2021) emphasized the role of academic self-efficacy in mediating the relationship between students' perceptions of feedback and their academic attainment, suggesting that workshops could potentially enhance self-efficacy and, in turn, academic performance. However, Xu et al., (2021) suggested that the effectiveness of study strategies, such as those taught in workshops, can vary, with self-testing, scheduling, and concept maps showing positive correlations with academic performance.

## Objective

The primary objective of this study is to identify the factors influencing the students' intention to study General Chemistry course through the scientific workshop. We are interested in determining the impacts of the workshop which is the intention to study General Chemistry course (dependent variable) through three independent variables-confidence to study General Chemistry course, understanding of General Chemistry course and the effectiveness of the workshop.

The research question was: What variables affect the students' intention to study General Chemistry course?

## METHODOLOGY

This study is based on the Theory of Planned Behavior (TPB) by Ajzen (1991). The TPB theory is a well-known theory to explain human behavior, hypothesizes that intention is the strongest predictor of behavior, whereas attitude, subjective norms, and perceived behavioral control predict the intention (Ajzen, 1991). Hence, the independent variables in this study were the understanding of the course, effectiveness of the workshop and confidence to study the course. The three independent variables were assumed to have influence on the dependent variable, which was the intention to study the course. Based on the TPB theory and the literature review, the proposed framework for the present study illustrated in Figure 1.

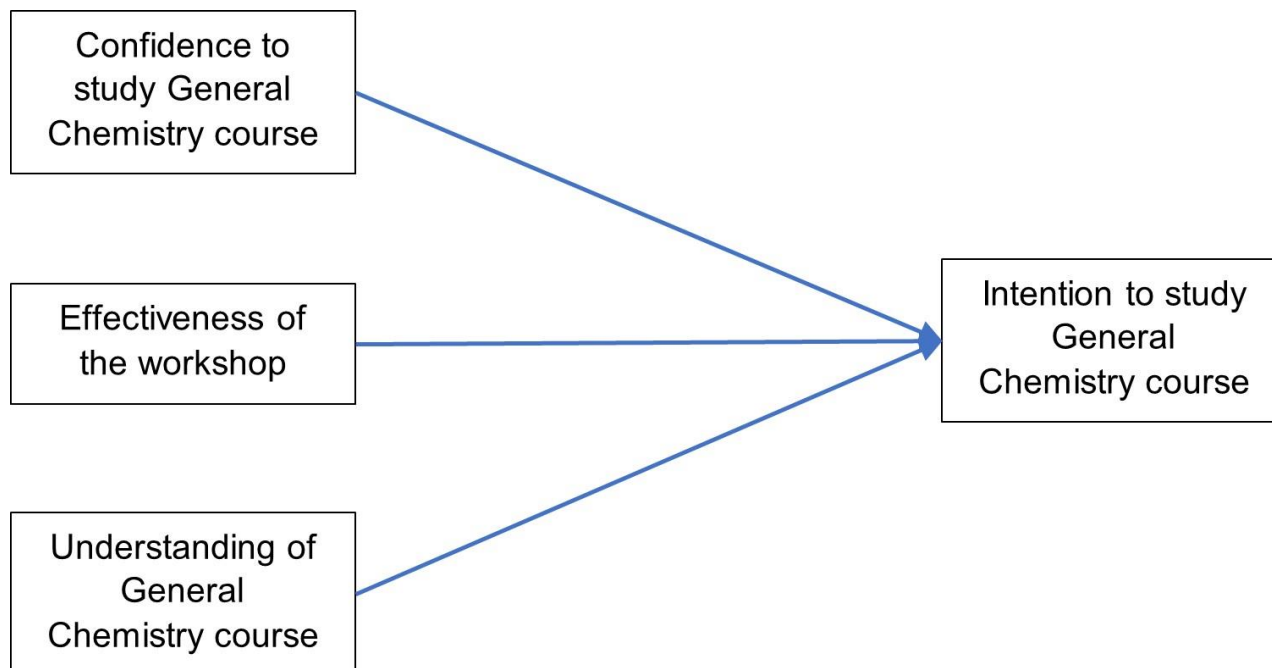


Figure 1: Conceptual framework

The present study focuses on the students enrolled in Diploma in Science program, intake session 1 2023/2024 (Semester October 2023 to February 2024) of UiTM Sabah Branch (Kota Kinabalu Campus), specifically those without a background in pure science. The scientific workshop program is planned to be conducted before the test of the General Chemistry course. This effort is initiated by the lecturers teaching the course to assist the students without a pure science background in enhancing their understanding of the course just before the scheduled test. Three lecturers, who are responsible for teaching the course, serve as both facilitators and speakers during the workshop. This workshop focuses on discussing the samples from previous tests, covering various question examples and topics. The discussion is a two-way communication where students are free to pose questions to the lecturers throughout the workshop. Because of the constrained availability of free time for both students and lecturers, the workshop is only conducted for half a day. At the conclusion of the workshop, a survey was disseminated to students via Google Form to gather their perspectives on the workshop. The survey data is subsequently analysed descriptively to determine if the workshop has achieved its objectives.

## RESULT

A total number of 49 out of 61 respondents have participated in the survey, with 67% female and 33% male. Despite not having a background in pure science, majority of the respondents (80%) opted for a Diploma in

Science due to their interest in pursuing further studies within the science field.

Table 3: Demography of respondents based on gender (N = 49)

Variable	Definition	Value (%)
Gender	Male	33
	Female	67

Table 4: Reasons in choosing Diploma in Science

Selection	Value (%)
I like to further study in science field.	80
My parent choices of program.	14
I want to try new thing.	2
I just take the option given by UPU.	2
My third choice.	2

What variables affect the students' intention to study General Chemistry course?

Our findings shows that the confidence in taking the test and understanding in General Chemistry course were among the variables that affect the students' intention to study General Chemistry course.

Variable on the effectiveness of the workshop was found out to not affecting the students' intention to study General Chemistry course but just the individual perspective on the students' experience and the workshops' content.

Table 5: Confidence level of the respondents before and after attending the workshop

Scale	Value (%)	
	Before	After
Very Confident	0	6
Confident	2	25
Moderately Confident	22	47
Slightly Confident	33	20
Not Confident	43	2

The assessment of confidence levels was attained from the feedback of the respondents in the survey. Table 5 shows a notable increase in the respondents' confidence levels after the workshop. Prior to attending the workshop, almost half of the respondents lacked confidence in taking the test (43%). However, this percentage decreased significantly to 2% after the workshop. There was a 13% decrease in the "slightly confident" level after the respondents participated in the workshop. In terms of "moderately confident" level, the percentage doubled after the workshop (47%) compared to before (22%). The "confident" level also experienced a substantial increase of 23% post-workshop. Additionally, there was a 6% rise in the "very confident" level after the respondents attended the workshop. These results clearly indicate that the workshop had enhanced the respondents' confidence levels and indeed supported the previous finding where workshop can boost students' confidence.

Table 6: Assessment of the respondents' understanding of the given topics.

Topic	Very Poor		Poor		Fair		Good		Very Good	
	Before	After	Before	After	Before	After	Before	After	Before	After
Chapter 1: Nomenclature of compounds.	4	0	13	3	19	20	14	24	2	2
Chapter 1: Empirical and molecular formula.	5	0	9	3	18	14	16	28	3	4
Chapter 1: Stoichiometric calculation, limiting reactants and reaction yields.	9	0	12	6	15	18	14	23	2	2
Chapter 2: Bohr's Theory of hydrogen atom.	8	1	17	6	15	20	9	21	2	2
Chapter 2: Electron Configuration.	7	0	14	5	18	18	8	21	4	5
Chapter 2: Periodic trends of element.	7	1	13	5	20	18	9	22	2	3
Chapter 3: Ionic and Covalent bond; formation and properties.	8	1	12	5	19	19	9	21	3	3
Chapter 3: Lewis's structure of molecules and molecular shape.	8	1	17	3	14	17	11	23	3	5
Chapter 3: Intermolecular forces: Hydrogen bond, van der Waals, dative covalent bonds.	9	1	16	6	17	19	6	21	3	2

Table 6 illustrates an overall improvement in respondents' understanding of each topic after participating in the workshop. The most significant change is noted in the "good" scale, with a substantial increase, followed by the "poor" scale, which sees a slight decrease after the respondents have participated in the workshop. However, the "fair" scale shows minimal change, and some topics exhibit no change at all. This pattern mirrored in the "very good" scale. There is also a slight decrease in frequency on the "very poor" scale after the workshop. In terms of topics, respondents generally have a better understanding of those in Chapter 1 compared to those in Chapters 2 and 3. This result indicates that there is an increase of understanding of the respondents on each topic after the workshop. This finding also supported the previous studies stating that a workshop can enhance students' understanding through change in students' thinking traits in terms of teamwork and visualization, engaging students in learning and developing higher-order skills (Fu et al., 2020; Dahal and Pangeni, 2019).

Table 7: The respondent's perception of the workshop

Scale	Value (%)
Very Effective	16
Effective	49
Neutral	23
Ineffective	8

Very Ineffective	4
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Table 7 shows that 65% of the respondents express agreement regarding the workshop's effectiveness in enhancing their comprehension of the general chemistry course. Subsequently, 23% opted for a neutral stance, while 12% indicated that they perceive the workshop as ineffective. Those who chose neutral or ineffective may not have harbored particularly positive or negative opinions about their workshop experience. Various factors could have influenced respondents' choice, as emphasized in the comment section of the survey. Some mentioned concerns include the inconvenience of the workshop venue due to a high number of participants, the absence of group activities that could enhance their understanding, dissatisfaction with the insufficient provided tips, and the perceived insufficiency of the workshop's duration, among others. Despite the 12% of respondents who deemed the workshop ineffective, all participants consistently agreed that the workshop should be conducted again before the upcoming test. This result is supported by the previous studies where the effectiveness of a workshop can be influenced by various factors, including the participants' prior experience and the content of the workshop (Strietzel et al., 2020; Maleki et al., 2018; Henry et al., 2020 and Mohanty et al., 2019).

## CONCLUSION

Following the completion of the scientific workshop, particularly for the students without a pure science background taking the general chemistry course, their feedback indicates that their intention to study the General Chemistry course were influenced by their confidence levels and their understanding of the General Chemistry course. The variable on effectiveness of the workshop was found out to not affecting their intention to study the General Chemistry course but only their individual perspective on their experience and the workshops' content. Consequently, this scientific workshop is considered effective in assisting the student to study the General Chemistry course from the notable boost in their confidence levels and elevated understanding of the covered topics.

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## AUTHOR CONTRIBUTIONS

All authors contributed to the design of the research, the questionnaire, and the write-up. The on-line survey, data cleaning and tabulation was undertaken by UiTM Sabah Branch. All authors have read and approved the final manuscript.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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