Jurnal PAJAR (Pendidikan dan Pengajaran)
Volume 10 Nomor 3 May 2026 | ISSN Cetak : 2580 - 8435 | ISSN Online : 2614 - 1337
DOI : http://dx.doi.org/10.33578/pjr.v10i3.1323

Factors Influencing Learning Difficulties in Stoichiometry Among Chemistry Education Students

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ABSTRACT

Learning difficulties in the Basic Chemistry course remain a common problem among chemistry education students, especially in stoichiometry, as reflected in low final examination scores. Therefore, this study aims to analyze the factors contributing to learning difficulties in stoichiometry among chemistry education students in a Basic Chemistry course. This research employed a quantitative descriptive method involving 48 students selected through purposive sampling. Data were collected using questionnaires, interviews, and documentation. Data were analyzed using descriptive percentage analysis to determine the relative contribution of each factor. The results reveal that learning difficulties are influenced by internal and external factors. Internal factors include physical condition (50%), categorized as Poor; physiological function (29%), categorized as Very Poor; interest (29%), categorized as Very Poor; and motivation (32%), categorized as Very Poor. Meanwhile, external factors consist of family environment (22%), in the Very Poor category, campus environment (31%) in the Very Poor category, and community environment (29%) in the Very Poor category. The percentages indicate the relative contribution of each factor to students' learning difficulties, with physical condition emerging as the most dominant factor affecting students' understanding of stoichiometry. These findings underscore the need for lecturers to develop more effective learning strategies, increase students' motivation and interest, and create a supportive learning environment. In addition, students are expected to improve their learning readiness and actively manage their learning conditions in order to better understand stoichiometry.

Keywords*: *factors, learning difficulties, basic chemistry, stoichiometry

Submitted	Accepted	Published
18 February 2026	10 March 2026	30 May 2026

Citation	:	Monika., Enawaty, E., & Ifriany, A. (2026). Factors Influencing Learning Difficulties In Stoichiometry Among Chemistry Education Students. *Jurnal PAJAR (Pendidikan dan Pengajaran), 10*(3), 285-301. DOI: http://dx.doi.org/10.33578/pjr.v10i3.1323.

INTRODUCTION

Basic Chemistry is a compulsory course that provides the fundamental chemical concepts that pre-service chemistry teachers must master. The purpose of the course is to provide students with a deep understanding of basic concepts in chemistry. The competencies acquired from this course serve as an essential foundation for studying more advanced chemistry courses (Nugraha et al., 2024). Therefore, a good mastery of basic chemistry concepts will help students understand more complex chemistry topics. At the university level, the Basic Chemistry course contains concepts that are quite complex for students to understand. This is because the material involves chemical reactions, mathematical calculations, and abstract concepts (Andriani, 2023). In the Chemistry Education Study Program at the Faculty of Teacher Training and Education, Universitas Tanjungpura, Basic Chemistry is a compulsory first-semester course totalling 3 credits, integrated with laboratory practice. The lecture component is worth 2 credits, whilst the laboratory component is worth 1 credit. The topics covered include fundamental concepts of chemistry; atomic theory and matter; atomic structure and periodic properties of elements; chemical bonding; stoichiometry; solutions; acids and bases; and thermodynamics.

However, in reality, there are still students in the odd semester of the 2024/2025 academic year who obtained scores below 60 in the Basic Chemistry course. Students' learning difficulties are evident in the Final Examination scores: of 61 students who took the exam, 48 scored below 60. This indicates that numerous students have not yet achieved the expected learning outcomes. Based on interviews, students stated that stoichiometry is one of the most difficult topics. The difficulties experienced include converting

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moles to mass, volume, and number of particles; determining empirical and molecular formulas; and calculating limiting and excess reactants.

Stoichiometry is a rather difficult topic for students to learn and understand. These difficulties arise because chemical reactions observed at the macroscopic level form the main basis of stoichiometry, while atoms and molecules cannot be directly observed at the submicroscopic level. In addition, students must be able to interpret various representations, including symbols, chemical formulas, and mathematical equations. Therefore, effective stoichiometry learning should help students understand and connect concepts at the macroscopic, submicroscopic, and symbolic levels (Lausin, 2019). Previous studies also report that students often experience difficulties linking these different levels of representation in chemistry learning (Johnstone, 1991; Treagust et al., 2003).

Learning difficulties are obstacles experienced by students during the learning process that result in the failure to achieve learning objectives (Winarti, 2021). The factors influencing learning difficulties can be classified as internal and external. Internal factors include physical condition, physical function, intelligence, motivation, interests, attitudes, and aptitudes. External factors include the school environment, family environment, and community environment (Hanim et al., 2022).

Previous studies have identified various factors that contribute to learning difficulties in stoichiometry. Research by Qorinallah & Bahriah (2025) found that learning difficulties were influenced by interest, motivation, intelligence, family environment, and school environment. Similarly, Allo & Azrun (2023) reported that learning difficulties were caused by low numerical ability, lack of understanding of the material, weak motivation, limited student insight, and less supportive study conditions. Evangelista et al. (2022) also found that factors such as concept mastery, intelligence, and social environment influence students' difficulties in learning stoichiometry.

However, most previous studies have focused on general learning difficulties in chemistry and have been conducted in different educational contexts. Limited studies have specifically analyzed the factors contributing to learning difficulties in stoichiometry among first-year chemistry education students in Indonesian higher education, especially in the Basic Chemistry course. Understanding these difficulties is essential because stoichiometry is a fundamental concept that supports students' understanding of other chemistry topics. Identifying these factors can provide useful information for lecturers in designing more effective learning strategies and for students in overcoming their learning difficulties. Therefore, this study aims to analyze the factors contributing to learning difficulties among chemistry education students in the Basic Chemistry course, specifically in stoichiometry.

LITERATURE REVIEW

Learning Difficulties

Learning difficulties are conditions in which students encounter obstacles that prevent them from achieving expected learning outcomes (Iman, 2024; Urbayatun et al., 2019). These obstacles may arise from internal conditions within the students or from external environmental factors that influence the learning process (Salsabila et al., 2024). However, contemporary research suggests that learning difficulties should not be understood merely as individual limitations, but as multidimensional phenomena resulting from the interaction between cognitive readiness, instructional design, and contextual factors.

In science education, particularly in chemistry, learning difficulties frequently arise from the abstract and hierarchical nature of concepts. Students are required to integrate conceptual understanding, mathematical reasoning, and symbolic interpretation (Chandrasegaran et al., 2007; Davidowitz et al., 2010). Chemistry learning involves connecting macroscopic observations, submicroscopic particle explanations, and symbolic representations, as emphasized in the triplet representation framework proposed by Johnstone (1991). When these representations are not explicitly linked during instruction, students often rely on algorithmic procedures rather than meaningful conceptual reasoning, leading to misconceptions and fragmented understanding (Fitriani et al., 2022).

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Learning difficulties can be identified through observable indicators such as low academic achievement, minimal participation in learning activities, and delays in completing assignments (Herman et al., 2023). These indicators demonstrate that learning difficulties encompass cognitive barriers as well as motivational and behavioral dimensions. Thus, the phenomenon involves not only intellectual capacity but also engagement, persistence, and learning strategies.

Factors Influencing Learning Difficulties

Learning difficulties are influenced by both internal and external factors (Sayekti et al., 2020). Internal factors include physical and psychological conditions such as health, intelligence, interest, motivation, and attitudes toward learning (Rofiqi & Rosyid, 2020; Wahab & Rosnawati, 2021; Mahmud, 2022). These internal characteristics affect students' ability to regulate attention, maintain persistence, and process complex academic material.

External factors come from the family, school, and community environments, including parental support, teaching methods, learning facilities, and social interactions that affect students' understanding and learning outcomes (Setiawan, 2017; Asmal & Taufik, 2023; Hanim et al., 2022; Radhiah et al., 2024). Research in chemistry education further shows that instructional approaches that emphasize procedural problem-solving without conceptual scaffolding tend to reinforce superficial understanding (Chandrasegaran et al., 2007).

Basic Chemistry Course

Basic Chemistry is a compulsory foundational course that prepares students for advanced subjects, including organic, inorganic, analytical, and physical chemistry (Rahmi et al., 2024). It introduces essential concepts, including atomic structure, chemical bonding, chemical reactions, thermochemistry, and stoichiometry. Mastery of these fundamental topics is crucial because they form the conceptual framework for advanced chemical reasoning.

Among these topics, stoichiometry is consistently reported as one of the most challenging areas in introductory chemistry. Stoichiometry examines quantitative relationships between substances involved in chemical reactions (Celikkıran, 2020). It requires not only conceptual understanding but also calculation skills, including determining moles, mass, volume, limiting reagents, and reaction yields (Sudirman, 2021). Therefore, this topic requires integrating conceptual understanding, proportional reasoning, and mathematical abilities.

Furthermore, understanding stoichiometry is closely related to the ability to connect the symbolic representation of chemical equations with particulate meaning and observable macroscopic phenomena (Davidowitz et al., 2010). When students rely solely on algorithmic procedures without understanding the underlying chemical meaning of mole ratios or the concept of the limiting reagent, problem-solving becomes mechanical and error-prone (Fitriani et al., 2022). These findings indicate that difficulties in stoichiometry are not merely computational issues but reflect deeper problems in conceptual and representational integration.

METHOD

This study employed a descriptive quantitative method to analyze the factors contributing to learning difficulties among chemistry education students in the Basic Chemistry course on stoichiometry. The research was conducted on odd-semester students of the 2024/2025 academic year in the Chemistry Education Study Program at Faculty of Teacher Training and Education in Universitas Tanjungpura. The research subjects consisted of 48 students selected through purposive sampling based on the criterion of having a Final Examination (UAS) score below 60 in the Basic Chemistry course during the odd semester of the 2024/2025 academic year. The research was conducted from June 5 to July 10, 2025.

The instruments have undergone content validity assessment by two experts, one lecturer in chemistry education and one guidance and counseling (BK) teacher. The validation process used Aiken's V to assess the

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level of agreement among validators on the relevance of each item. The results revealed an Aiken's V index of 0.83, indicating that the instrument had high content validity. The reliability of the questionnaire was tested using Cronbach's Alpha. The analysis yielded a reliability coefficient of 0.84, which indicates good internal consistency. Therefore, the instrument was considered valid and reliable for data collection.

Unstructured interviews were conducted to obtain additional information regarding the factors contributing to students' learning difficulties and to support the questionnaire results. The interview data were analyzed descriptively to strengthen the questionnaire findings. Documentation was used to obtain data on the number of students enrolled in the Basic Chemistry course and their Final Examination (UAS) scores during the odd semester of the 2024/2025 academic year. Each questionnaire item has four response options: strongly agree (SA), agree (A), disagree (D), and strongly disagree (SD). The scoring criteria for each item are presented in Table 1.

Table 1. Assessment Criteria

Answer Choices	Statement Score	
	Positive (+)	Negative (-)
Strongly Agree (SA)	4	1
Agree (A)	3	2
Disagree (D)	2	3
Strongly Disagree (SD)	1	4

In this study, the data were analyzed using descriptive statistics by calculating the percentage of respondents' answers for each aspect of the learning difficulty factors. The results of the data processing were presented in percentage form to describe the tendency of respondents' answers related to the factors causing students' learning difficulties in the Basic Chemistry course on the topic of stoichiometry. The questionnaire data are analyzed using the following formula:

$$P = \frac{F}{N} \times 100\%$$

Where:
P = Percentage value sought
F = Total score obtained
N = Maximum score
100 = Constant number
(Riduwan, 2014)

After calculating the percentages, the results are categorized according to the percentage criteria. The percentage criteria used in this study are presented in Table 2.

Table 2. Percentage Criteria

Percentage	Criteria
80% -100%	Very Good
70% - 79%	Good
60% - 69%	Fair
50% - 59%	Poor
0% - 49%	Very Poor

Source: Afrianti et al. (2025)

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To analyze the interview data, the researcher selected respondents representing 25% of the total student population. The interview responses were recorded and analyzed descriptively to support and strengthen the questionnaire findings.

RESULTS AND DISCUSSION

Students' learning difficulties in stoichiometry are influenced by both internal and external factors. Internal factors include physical condition, physiological functions, interests, and motivation, while external factors include the family, campus, and community environments. Figure 1 presents the percentage of factors contributing to students' overall learning difficulties.

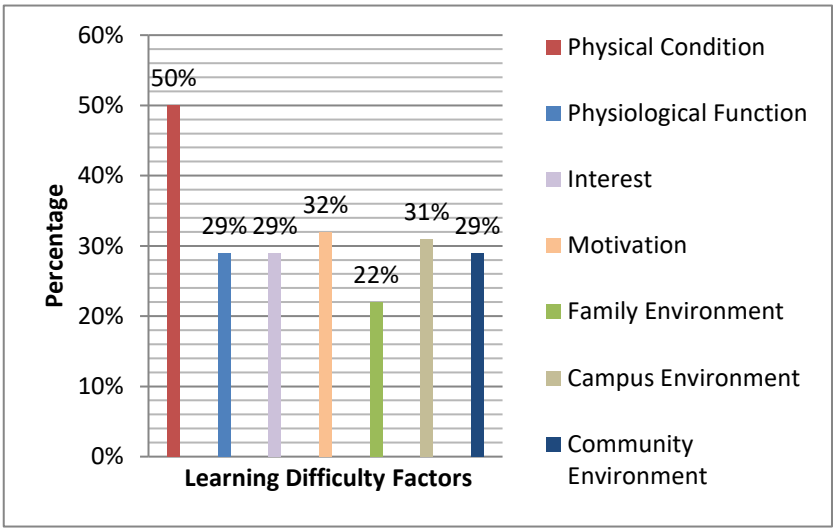


Figure 1. The Average Percentage of Factors Influencing Overall Learning Difficulties

Internal factors originate from within the students and may influence their ability to understand learning materials. One essential aspect is physical condition. This aspect consists of fatigue, dizziness, and lack of sleep, which are measured through three questionnaire statements. The percentage of students' responses for each statement is presented in Table 3.

Table 3. Students' Responses to the Physical Condition Aspect

No	Statements	Answer Criteria			
		SA	A	D	SD
1.	I find it difficult to understand stoichiometry material because of fatigue	40%	52%	8%	0%
2.	I easily feel dizzy when studying stoichiometry	10%	67%	23%	0%
3.	I often stay up late, which makes it hard to focus when learning stoichiometry	19%	46%	35%	0%

The results present that 92% of students experience difficulty understanding stoichiometry when they feel tired. In addition, 77% of students report feeling dizzy while studying the material, and 65% admit that staying up late makes it difficult for them to concentrate during lectures. Based

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on the questionnaire analysis, 50% of respondents indicate that physical condition contributes to learning difficulties, which is categorized as "poor" in Table 2. This result indicates that physical condition is reported more frequently than other factors analyzed in this study. Interview results also support these findings. Several students report that they often stay up late to complete laboratory reports and other coursework, leading to fatigue and difficulty concentrating during lectures. Poor time management is also cited as a factor contributing to the accumulation of assignments. Previous studies have shown that physical health plays a crucial role in the learning process.

Students with good physical condition tend to have better concentration and learning performance. Research by Utari et al. (2024) reveals that physiological factors, such as illness or poor physical health, can lead to learning difficulties by interfering with students' concentration during learning. Conversely, poor physical condition may lead to fatigue, reduced concentration, and decreased motivation in learning (Wahab & Rosnawati, 2021; Iman, 2024). Poor sleep patterns among students are also associated with low learning concentration and can affect study efficiency as well as daily activities (Asyari et al., 2024). Previous studies have shown that sleep deprivation is common among university students and may negatively affect learning ability, cognitive performance, and academic achievement (Hershner & Chervin, 2014; Curcio et al., 2006). Students who experience sleep problems are also reported to have a higher risk of academic difficulties and lower academic performance (Gaultney, 2010). In addition, fatigue has been reported to have a relationship with academic achievement, because learning achievement is the result of an optimal learning process (Welong et al., 2020).

In terms of physiological function, two indicators examined are visual and hearing abilities. These indicators are measured using two questionnaire statements. The percentage of students' responses to each statement is presented in Table 4.

Table 4. Students' Responses to the Physiological Function Aspect

No	Statements	Answer Criteria			
		SA	A	D	SD
1.	I have difficulty seeing the stoichiometry material presented by the lecturer	2%	21%	69%	8%
2.	I have difficulty hearing the stoichiometry material presented by the lecturer	0%	19%	75%	6%

The results indicate that 77% of students are able to see the stoichiometry material clearly. Meanwhile, regarding the hearing indicator, 81% of students indicate they could hear the lecturer's explanation well during the lesson. Based on the questionnaire analysis, 29% of respondents imply that physiological function contributes to learning difficulties, which is categorized as Very Poor according to Table 2. The Very Poor category indicates that physiological factors have a relatively small contribution to students' learning difficulties in stoichiometry. However, the data elucidate that most students' visual and hearing abilities generally support the learning process. Wahab & Rosnawati (2021) state that physiological functions, particularly the senses, play a vital role in the learning process. Vision and hearing are the primary channels through which students receive information from their environment. When these sensory functions function properly, the learning process becomes more effective, whereas impairments in vision or hearing may hinder students' ability to receive information. In line with this, Utari et al. (2024) report that limitations in vision and

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hearing can disrupt students' concentration and potentially lead to learning difficulties. Pang et al. (2024) also found that visual impairment is associated with students' learning outcomes, as limited vision may affect their ability to access visual information during learning. Similar findings have also been reported in higher education contexts, where students with visual impairments experience difficulties in accessing learning materials and completing academic assessments (Alsamiri, 2025). Research by Hill et al. (2019) conveys that students with both visual and hearing impairments are less likely to meet academic standards than students without sensory impairments. These findings indicate that physical functioning, particularly vision and hearing, is a pivotal factor that may contribute to learning difficulties.

In the interest aspect, two indicators examined include enjoyment in participating in learning and interest in the material. These indicators are measured through three questionnaire statements. The percentage of students' responses for each statement is presented in Table 5.

Table 5. Students' Responses to the Interest Aspect

No	Statements	Answer Criteria			
		SA	A	D	SD
1.	I feel happy when learning stoichiometry	2%	63%	35%	0%
2.	I am interested in learning stoichiometry	8%	65%	27%	0%
3	I look for additional learning resources on stoichiometry outside the classroom	15%	70%	15%	0%

The results illustrate that 83% of students feel happy when learning stoichiometry. In addition, 73% of students express interest in studying stoichiometry, and 85% look for additional learning resources outside the classroom. Based on the questionnaire analysis, 29% of respondents indicate that interest contributes to learning difficulties, which is categorized as Very Poor according to Table 2. The Very Poor category, in this research context, implies that interest has a relatively small contribution to students' learning difficulties in the stoichiometry topic of the Basic Chemistry course. However, the results underscore that most students have a positive attitude toward learning stoichiometry, although some still lack interest or enjoyment during the learning process. Learning interest influences the quality of students' learning outcomes in a particular subject. Without interest in the learning material, students tend to be less motivated to study effectively because they lack engagement with the material (Mahmud, 2022). Learning interest plays an essential role in encouraging students' engagement in the learning process. Interest can stimulate students to seek further information and to persist in understanding material considered difficult through deeper engagement with the learning content (Renninger & Hidi, 2022). In line with this, a study by Lumbantoruan et al. (2025) mentioned that students' difficulties in understanding stoichiometry are influenced by their low interest in learning the material. Low interest in learning causes students to be less involved in the learning process, resulting in difficulties understanding concepts and solving stoichiometric calculations. Other studies have also examined how interest in learning can enhance the chemistry learning process by fostering enjoyment and increasing students' self-efficacy with chemistry material (Ghufrooni et al., 2019). In addition, Nureva and Mariyana (2019) state that students with a high interest in learning tend to be more focused during the learning process, enabling them to achieve better learning outcomes. Therefore, learning interest is a crucial factor to consider in the learning process to help minimize students' learning difficulties.

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In the motivation aspect, three indicators consist of enthusiasm for learning, diligence in completing assignments, and perseverance. These indicators are measured through five questionnaire statements. Table 6 presents the percentage of students' responses to each statement related to motivation.

Table 6. Students' Responses to the Motivation Aspect

No	Statements	Answer Criteria			
		SA	A	D	SD
1.	I am always enthusiastic when I study stoichiometry	5%	60%	35%	0%
2.	I try to complete stoichiometry assignments from the lecturer on time and with full effort	19%	77%	4%	0%
3.	I do my stoichiometry assignments close to the submission deadline	15%	56%	29%	0%
4.	I continue working on stoichiometry tasks even when I experience difficulties until I find the answer	38%	62%	0%	0%
5.	I feel disappointed when I get a low score, which makes me reluctant to study difficult material	17%	42%	41%	0%

The results demonstrate that 65% of students indicate enthusiasm when studying stoichiometry. Furthermore, 96% attempt to complete assignments seriously and on time. However, 71% admit that they tend to work on assignments close to the submission deadline. All students state that they continue working on tasks even when they encounter difficulties. Additionally, 59% report feeling disappointed when receiving low scores, which sometimes reduce their willingness to study difficult material. Based on the questionnaire analysis, 32% of respondents imply that motivation contributes to learning difficulties, which is categorized as Very Poor according to Table 2. The Very Poor category refers to the motivation that has a relatively small contribution to students' learning difficulties in the stoichiometry topic of the Basic Chemistry course. However, finding reveals that numerous students still try to complete assignments and solve problems during the learning process. These findings are supported by interview results, which indicate that several students experience difficulties in managing their time due to the large number of academic tasks, especially laboratory reports. As a result, they tend to complete assignments close to the submission deadline. Previous research indicates a positive relationship between time management and learning motivation. Better time management can increase students' motivation to learn (Nggie, 2016). In addition, students note that stoichiometry is a difficult topic, as it requires conceptual understanding, logical reasoning, and calculation skills. This is in line with Rofiqi & Rosyid (2020), who state that students with high motivation tend to be enthusiastic, persistent, and active in solving learning problems, while students with low motivation are more likely to experience learning difficulties. These findings are supported by a study by Andriani (2023), which states that low learning motivation can be one of the factors contributing to learning difficulties. In addition, learning motivation plays an essential role in increasing students' engagement and persistence in the learning process (Ramadhani et al., 2022). Other studies have also shown that motivation is closely related to students' academic engagement (Acosta-Gonzaga, 2023; Guo, 2018) and can encourage discipline in completing assignments while

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reducing levels of academic procrastination (Rezkia et al., 2022). Therefore, learning motivation is a crucial factor to consider to help reduce students' learning difficulties.

External factors include the family, campus, and community environments. In the family environment aspect, there is one indicator, family economic condition, which is measured through two statements. Table 7 presents the percentage of students' responses to each statement related to the family environment.

Table 7. Students' Responses to the Family Environment Aspect

No	Statements	Answer Criteria			
		SA	A	D	SD
1.	My parents fulfill my learning needs	33%	61%	6%	0%
2.	My parents pay little attention to my learning needs	6%	8%	67%	19%

The results spell out that 94% of students agree that their parents fulfill their learning needs. Furthermore, 86% of students disagree with the statement that their parents pay little attention to their learning needs, indicating that most parents provide adequate attention to their children's academic activities. Based on the questionnaire analysis, 22% of respondents indicate that the family environment contributes to learning difficulties, which is categorized as "Very Poor" in Table 2. The Very Poor classification interprets that the family environment has a relatively small contribution to students' learning difficulties in the stoichiometry topic of the Basic Chemistry course. Nevertheless, the data imply that a small proportion of students still experience limited parental support, either in terms of access to learning facilities or in providing academic attention. Parents' economic conditions play a significant role in supporting children's education. Students require the fulfillment of physical and psychological needs, such as adequate nutrition, health care, proper clothing, learning facilities (books, stationery, internet access), sufficient lighting, and a conducive study space. These needs can be optimally fulfilled when parents have adequate economic resources. Conversely, limited economic conditions may restrict access to learning facilities, affect students' well-being, reduce self-confidence, and ultimately influence learning outcomes (Mahmud, 2022). The family environment, as an external factor, also influences students' learning difficulties. Less supportive family conditions, such as limited learning resources at home, insufficient educational expenses, and the absence of a conducive study environment, may hinder students' learning. These conditions make it difficult for students to study optimally, which in turn affects their understanding of the learning material (Damanik et al., 2022; Alo & Azrun, 2023). Several studies have shown that family socioeconomic status (SES) affects students' academic engagement and achievement. Li, Xu, and Xia (2020) report that SES influences academic achievement through students' self-concept, while Li, Xiao, and Song (2024) discover that SES affects learning behavior through self-esteem. Other studies have also shown that students from families with higher socioeconomic status tend to have better access to learning resources, more adequate family support, and higher levels of learning engagement compared to students from lower socioeconomic backgrounds (Bradley & Corwyn, 2002; Sirin, 2005). In addition, family socioeconomic conditions are associated with learning opportunities, the quality of the educational environment, and parental involvement in students' academic development (Davis-Kean, 2005). Other studies also emphasize that family socioeconomic background may influence students' motivation to learn and opportunities for academic success

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through family support and access to adequate learning resources (Reardon, 2011; Chiu & Chow, 2015). Research by Hair et al. (2015) elucidates that family socioeconomic status plays a fundamental role in shaping students' cognitive development, which directly affects academic achievement.

Thus, family economic conditions not only affect the availability of learning facilities but also influence psychological aspects, motivation, and students' academic engagement, which may ultimately contribute to learning difficulties.

In the campus environment aspect, three indicators refer to teaching methods, learning media, and peer relationships. These indicators are measured through nine questionnaire statements. Table 8 presents the percentages of students' responses to each statement related to the campus environment.

Table 8. Students' Responses to the Campus Environment Aspect

No	Statements	Answer Criteria			
		SA	A	D	SD
1.	The lecturer's teaching method makes me enjoy learning stoichiometry	6%	63%	29%	2%
2.	The lecturer explains stoichiometry too quickly, which makes it difficult for me to understand the material	23%	56%	21%	0%
3.	The lecturer's way of explaining stoichiometry is easy to understand	2%	65%	33%	0%
4.	The learning media used by the lecturer are interesting	2%	69%	27%	2%
5	I find it difficult to understand stoichiometry because the learning media used by the lecturer do not match my learning style	2%	54%	44%	0%
6	My classmates do not form groups or differentiate between friends when studying stoichiometry	13%	63%	22%	2%
	I do not have study partners in class				
7.	I am not very close to my classmates	0%	8%	54%	38%
8.	I often discuss with my classmates to	2%	15%	44%	40%
9.	understand stoichiometry	20%	65%	13%	2%

The results depict 69% of students agree that the lecturer's teaching method makes learning enjoyable. However, 79% lecturer explains the material too quickly, making it difficult to understand. Meanwhile, 67% the explanations are generally easy to follow. Regarding learning media, 71% perceive them as interesting, although 56% are difficulties because the media do not match their learning styles. Regarding peer relationships, 76% report that classmates do not form exclusive groups. Additionally, 92% report having study partners, 83% feel close to their classmates, and 85% frequently discuss stoichiometry material with peers. Based on the questionnaire analysis, 31% of respondents indicate that the campus environment contributes to learning difficulties, which is categorized as "Very Poor" in Table 2. The Very Poor classification indicates that the campus environment has a relatively small contribution to students' learning difficulties in the stoichiometry topic of the Basic Chemistry course. However, several instructional factors still require attention. Although students generally perceive the teaching methods and learning media positively, the pace

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DOI : http://dx.doi.org/10.33578/pjr.v10i3.1323

of explanation is too fast, and the font size on PowerPoint slides is too small, making the material difficult to read. Rapid delivery of material can hinder students' comprehension, particularly in complex topics such as stoichiometry, which require conceptual understanding and calculation skills. This finding is consistent with Aini & Suhendra (2022), who state that lecturers' rapid explanation of material may limit students' ability to fully grasp concepts. Furthermore, students suggested using instructional videos and slower-paced explanations to enhance their understanding. This aligns with Hasanah & Kembaren (2025), who argue that limited interactive and engaging learning resources remain a challenge in chemistry education. With advancements in information technology, video-based instruction provides a more engaging alternative, allowing abstract stoichiometric concepts to be explained more clearly and systematically. These results are consistent with the study by Qorinallah et al. (2025), which indicates that the school environment is one of the factors influencing students' learning difficulties. Learning environment conditions, such as teaching methods and the use of instructional media, can affect students' understanding of the material and may potentially lead to learning difficulties. Previous studies have also shown that appropriate learning strategies can improve students' understanding by providing opportunities for greater active involvement in the learning process (Hariani, 2022). In addition, the use of instructional media that supports the visualization of concepts can help facilitate students' understanding of the material (Nursidiq & Batubara, 2020). This is supported by Hamisah et al. (2022), who found that interactive multimedia teaching materials can increase students' motivation and engagement in learning. Similarly, Galen et al. (2022) state that using a Game-Based Learning (GBL) strategy can make stoichiometry learning more engaging and help students understand concepts that are previously considered difficult. Furthermore, Alfiyanti & Sukarmin (2021) explain that stoichiometry is an abstract topic in chemistry because it involves macroscopic, submicroscopic, and symbolic representations, which often lead to misconceptions. Therefore, less varied teaching methods and learning media that do not adequately support concept visualization may become one of the factors contributing to learning difficulties, as also found in this study.

In the community environment aspect, two indicators consist of social media and peer interaction, each measures using six statements. Table 9 presents the percentage of students' responses to each statement related to the community environment aspect.

Table 9. Students' Responses to the Community Environment Aspect

No	Statements	Answer Criteria			
		SA	A	D	SD
1.	Social media provides various educational content that motivates me to learn stoichiometry	19%	71%	10%	0%
2.	Social media makes it easier for me to access additional learning resources about stoichiometry	23%	75%	2%	0%
3.	I spend too much time on social media, which causes me to delay completing my stoichiometry assignments	13%	46%	42%	0%
4.	My friends always ask me to work on assignments together	17%	63%	19%	2%
5.	When studying together, my friends only	2%	40%	54%	4%

Jurnal PAJAR (Pendidikan dan Pengajaran)
Volume 10 Nomor 3 May 2026 | ISSN Cetak : 2580 - 8435 | ISSN Online : 2614 - 1337
DOI : http://dx.doi.org/10.33578/pjr.v10i3.1323

	play and chat with each other				
6.	I often postpone studying because I choose to hang out or play with my friends instead	2%	19%	69%	10%

The findings reveal that 90% of students agree that social media provides educational content that motivates them to learn stoichiometry. Furthermore, 98% state that it facilitates access to additional learning resources. However, 58% admit that excessive social media use leads to a delay in completing assignments. Regarding peer interaction, 79% indicate their friends often invite them to work on assignments together. Additionally, 58% imply that they do not merely play or chat during group study sessions, and 79% do not delay studying due to social activities. These findings underscore that peer relationships generally provide positive academic support. Based on the questionnaire analysis, 29% of respondents indicate that the community environment contributes to learning difficulties, which is categorized as "Very Poor" in Table 2. The Very Poor classification implies that the community environment contributes relatively little to students' learning difficulties in the stoichiometry topic of the Basic Chemistry course. Interview results further reveal that students frequently use social media as a supplementary learning resource to better understand stoichiometry concepts. YouTube is identified as the most commonly used platform because it offers clearer, more accessible explanatory videos. Although social media supports access to learning, students acknowledge that it can also be a source of distraction, particularly when they are tempted to consume unrelated content. Popular platforms such as Facebook, Instagram, WhatsApp, TikTok, YouTube, Twitter, and Blogger each offer distinctive features that attract users and encourage prolonged online engagement (Asmal & Taufik, 2023). Evangelista et al. (2022) convey that difficulties in learning stoichiometry are influenced not only by internal factors but also by external factors in the social environment, including interactions on social media and with peers. Social media essentially has a dual impact on learning, in which it can enhance learning engagement when used strategically, but it may also cause distractions when used excessively. This is supported by the findings of Salari et al. (2025), who, through a meta-analysis, demonstrate that social networking addiction can disrupt attention and reduce academic performance. In addition, Lukose and Agbeyangi (2025) elucidate that although social media can facilitate learning activities, excessive use more often becomes a distraction that leads to decreased academic achievement. Wang et al. (2025) also report that social media can enhance learning engagement and academic achievement when used strategically; however, unregulated use may reduce learning efficiency. In line with these findings, other studies have also shown that uncontrolled use of digital devices can affect learning activities. Sinaga et al. (2022) mention that smartphone use influences students' learning motivation, which in turn affects their engagement in the learning process. Furthermore, Nurhidayah et al. (2021) emphasize that students' learning discipline during online learning tends to decline because the learning process takes place at home with more limited supervision. These situations indicate that technology-based learning environments can create various distractions that may affect students' engagement in learning activities. On the other hand, the development of digital technology has also made smartphones and various digital applications integral to learning activities in the modern era (Yunita et al., 2022). Social media platforms such as TikTok have even begun to be used as engaging, easily accessible learning media for students (Purnamaningsih, 2022). Therefore, although social media can serve as an alternative learning resource that supports conceptual understanding, uncontrolled use

may create distractions that contribute to learning difficulties, particularly in stoichiometry, which requires concentration and deep conceptual understanding.

These findings demonstrate that internal factors, particularly physical condition, play a more dominant role compared to external factors. Although environmental aspects such as campus and community settings influence the learning process, their impact is relatively limited. Therefore, interventions should prioritize improving students' physical readiness, time management skills, and adaptive learning strategies to reduce difficulties in understanding stoichiometry concepts.

CONCLUSIONS AND RECOMMENDATION

The present study infers that learning difficulties in stoichiometry in the Basic Chemistry course are influenced by internal and external factors. Internal factors include physical condition (50%), categorized as Poor, as well as physiological function (29%), interest (29%), and motivation (32%), which were categorized as Very Poor. External factors such as family environment (22%), campus environment (31%), and community environment (29%) were also classified as Very Poor. Among these variables, physical condition was identified as the most significant factor contributing to students' learning difficulties. These findings indicate that students' physical readiness and study management play a crucial role in understanding stoichiometry concepts. Therefore, lecturers are encouraged to implement more effective instructional strategies, such as interactive learning approaches, structured problem-solving exercises, and appropriate instructional media to support conceptual and quantitative understanding. Additionally, students are expected to improve self-regulation and maintain their physical condition to reduce learning difficulties. This study is limited to students from a single study program, which may affect the generalizability of the findings. Future research is recommended to include a larger, more diverse sample across multiple universities or academic programs to yield broader insights. Further studies may also explore the relationship between learning difficulties and specific instructional interventions to determine more targeted solutions.

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