IJCE, Vol. 1, No. 1, July 2024, pp. 1 – 6

Indonesian Journal of Chemical Education

https://journal.uny.ac.id/index.php/ijce/index

Chemistry Learning Anxiety Profile of Phase E Students of Public Senior High School in Sleman Regency

Hindun ✉ [1)], **Heru Pratomo**[2)]

[1, 2)] Department of Chemistry Education, Universitas Negeri Yogyakarta, Indonesia

Article Info

Received: May 30th, 2024
Revised: Jul 15th, 2024
Accepted: Jul 24th, 2024

Keywords:
chemistry learning anxiety, tenth-grade students, phase E

Abstract

Chemistry is still considered a subject that is difficult for some students to understand, thus triggering chemistry learning anxiety or chemophobia. This research aims to analyze the level of anxiety in studying chemistry in tenth-grade students at public senior high schools in Sleman Regency in participating in phase E chemistry learning. This quantitative research uses a survey method with a cross-sectional design. A total of 413 tenth-grade students from six public senior high schools in Sleman Regency were selected using cluster random sampling as the research sample. The instrument used is the chemistry learning anxiety scale, which consists of 50 statement items. The data results were analyzed using ideal assessment categories. The findings of this research revealed that students have low anxiety about studying chemistry in the phase E of chemistry learning. Low chemistry learning anxiety is a good asset for students to be able to follow and understand chemistry learning well in phase E and the following phases. Male students and students with good academic achievement tend to have lower chemistry learning anxiety than female students and students with less good academic achievement.

✉ Corresponding Author:
Hindun
hindun.2020@student.uny.ac.id

e-ISSN 2581-2645

INTRODUCTION

Chemistry is one of the important science subjects in the upper secondary curriculum but is often perceived as a difficult subject by some students (Woldeamanuel et al., 2013). Chemistry is seen as a very theoretical, complicated, and boring science (Huey, 2013). This is because chemistry material is abstract and conceptual (Taber, 2009). The amount of material about chemical structures is also the reason why this subject is difficult to understand (Sirhan, 2007). Johnstone (1974) added that the concept of moles, chemical formulas, and chemical reaction equations are the most difficult topics to understand from the students' point of view. Students also often experience failure when making connections between macroscopic and microscopic aspects of atoms and molecules (Gillespie, 1997). As a result, chemistry is seen as a burden in learning, triggering the emergence of chemistry learning anxiety or chemophobia (Huey, 2013).

The term chemophobia is used in two contexts, namely fear of chemistry as a lesson and fear of chemicals (Eddy, 2000). Chemistry learning anxiety can be in the form of excessive fear, unstable emotions, discomfort, and even worry in the learning process when unable to understand and solve a problem in learning chemistry (Pangestika & Wiyarsi, 2021). Psychological factors such as anxiety are one of the factors that cause learning difficulties in chemistry subjects with a percentage of 69.78% (Ristiyani & Bahriah, 2016).

Chemistry learning anxiety is caused by three factors, namely the chemistry learning process, chemistry evaluation, and the use of chemicals (Eddy, 2000; Huey, 2013; McCarthy & Widanski, 2009; Senocak & Baloglu, 2014). The difficulty of completing mathematical calculations in learning chemistry, the negative perception by students when listening to the word chemistry, and chemistry teachers lacking a good and correct understanding of

chemistry content are also factors that cause chemistry learning anxiety (Abendroth & Friedman, 1983). In addition, chemistry learning anxiety is also caused by too broad chemistry material studied, unclear career opportunities in chemistry, learning methods used by teachers, and inadequate teaching aids and laboratories (Jegede, 2007). Kaya & Yildirim (2014) revealed that unpleasant classroom activities, fear when facing tests, the attitude of teachers when teaching, and high expectations of parents on chemistry learning outcomes are also factors of chemistry learning anxiety in students.

Some of the impacts of chemistry learning anxiety experienced by students are decreased student interest in learning chemistry and showing inability to think, fear of failure, and self-blame (Huey, 2013). The decline in student success in receiving lessons is also due to learning anxiety (Anwar & Bhutta, 2014). This is supported by research conducted by Erdem (2012) which states that someone who experiences chemistry learning anxiety has low interest in learning chemistry, low chemistry learning motivation, poor learning outcomes, and poor performance skills.

One of the government's efforts in overcoming problems in the quality of Indonesian education such as student learning anxiety is to change the curriculum, which currently leads to the implementation of an Independent Curriculum (Musta, 2023). The independent curriculum was developed as a more effective and flexible curriculum framework that focuses on essential materials to develop student competencies (Almarisi, 2023). Rahayu et al. (2022) interpreted the independent curriculum as a learning design that provides opportunities for students to learn in a relaxed, calm, fun, stress-free, and pressure-free manner to show their natural talents. Learners are also freed to find their own preferred learning methods to reduce anxiety in the learning process (Badjeber et al., 2023). However, there are several barriers to the implementation of the independent curriculum (Rahayu et al., 2022). Some of these barriers are the lack of literacy and references, teachers' inexperience in designing differentiated learning, and students' readiness to make curriculum changes (Suryani et al., 2023).

The non-optimal implementation of the independent curriculum can affect student learning outcomes. This is in line with research conducted at one of the public senior high schools in West Pasaman Regency which shows that 72% of students from six phase E classes have scores below 75 on chemical reaction material (Yani & Yerimadesi, 2023). Furthermore, research by Yulika & Hardeli (2023) conducted on phase E students at three public senior high schools in Padang that have implemented the independent curriculum in the 2023/2024 school year shows that students still have difficulties in learning chemistry, especially the material on the basic laws of chemistry. Amaliyah et al. (2021) also stated that the factors associated with a decrease in learning outcomes for grade X students at two public senior high schools in South Tangerang were anxiety and self-efficacy. Female students have high anxiety, high self-efficacy, and good learning outcomes, while male students get the opposite results (Amaliyah et al., 2021)

Many studies related to chemistry learning anxiety have been conducted. However, studies that analyze the chemistry learning anxiety of phase E students in Sleman Regency who have just implemented the independent curriculum in the 2023/2024 academic year have not been carried out. Therefore, this research will focus on analyzing the level of chemistry learning anxiety of phase E students of public senior high schools in Sleman Regency.

METHOD

Research Design

This quantitative research uses a survey method with a cross-sectional design. This research design was used because data collection was only carried out at one specific time with the same research instrument.

Sample of Research

The population in this research included all tenth-grade students who have the same characteristics of student in the 17 public senior high schools in Sleman Regency, Yogyakarta Special Region, Indonesia. The population characteristics in this research use an independent curriculum, have a very good school accreditation, and have a chemistry laboratory. Thus, two steps of cluster random sampling were used to choose the school and to establish the research samples. In the first cluster random sampling, the researchers divided the Sleman Regency area into six clusters based on electoral areas and randomly selected one school from each cluster. After that, to determine the research sample, a second stage of cluster random sampling was carried out on the six selected schools. Researchers randomly selected two classes from each school as research samples. A total of 413 students (consisting of 138 male students and 275 female students) participated in this research.

Instrument of Research

The instrument used in this research is an adaptation of the chemistry learning anxiety scale developed by Pangestika & Wiyarsi (2021). The initial chemistry learning anxiety scale consists of 52 statements with four points of Likert-type scales (from 1 point = not anxious to 4 points = very anxious). Prior to use, the validity and reliability of the chemistry learning anxiety scale were carried out. Chemistry Education expert lecturers provide improvements in terms of content and language in the form of assessments of statement items. Necessary revisions were made following the feedback from the experts. The empirical validity was carried out by testing the instrument on 214 students. This data was analyzed using Confirmatory Factor Analysis (CFA) and showed that there were 2 items that did not have good validity. Thus, the final version of the chemistry learning anxiety scale consisted of 50 items and was used to obtain data on students' chemistry learning anxiety. In addition, the reliability of the chemistry learning anxiety scale was found to be very good with a Cronbach's alpha value of 0.959 (Gliem & Gliem, 2003). Therefore, the chemistry learning anxiety scale is a good instrument for collecting data on students' chemistry learning anxiety.

Prosedures of Research

The research procedure was carried out by administering an anxiety scale for learning chemistry directly in class during chemistry class hours. Students fill out the anxiety scale for studying chemistry via Google form with a time allocation of 90 minutes.

Data Analysis

Ideal assessment categories are used to analyze students' chemistry learning anxiety levels. The scores obtained from the chemistry learning anxiety scale are categorized into five level categories, namely very high, high, quite anxious, low, and very low.

FINDINGS AND DISCUSSION

Findings

Based on data obtained from the chemistry learning anxiety scale, descriptive statistics consisting of students' average scores and anxiety level categories are presented in Table 1. Data on students' chemistry learning anxiety are grouped into the categories very high, high, quite anxious, low, and very low following ideal assessment category Azwar (2015) were used. The Table 1 shows that the distribution of students' chemistry learning anxiety levels is dominant in the low category. However, the aspect of completing chemistry assignments shows that the category is quite anxious.

Table 1. The Findings of Descriptive Quantity of Students' Chemistry Learning Anxiety

Parameter	Overall Anxiety	Aspect of Chemistry Learning Anxiety		
		Study Chemistry	Finishing Chemistry Task	Laboratory Introduction
Ideal Score	200	52	48	100
No of Item	50	13	12	25
Mean	110.43	27.77	29.28	53.23
Level	Low	Low	Quite Anxious	Low

Table 2. Percentage of Students' Chemistry Learning Anxiety in Each Level Category

Category	Overall Anxiety	Percentage (%)		
		Study Chemistry	Finishing Chemistry Task	Laboratory Introduction
Very High	2	3	8	1
High	11	14	19	9
Medium	32	20	34	26
Low	38	38	25	44
Very Low	16	25	14	19

Students' chemistry learning anxiety levels can be influenced by their academic achievements. The distribution of students' chemistry learning anxiety levels based on academic achievement is depicted in Figure 1. Figure 1 shows that 60% of students with very poor academic achievement have chemistry learning anxiety levels in the high category. Meanwhile, 42% of students with excellent academic achievement had a low level of anxiety about studying chemistry. This shows that academic achievement has a negative relationship with chemistry learning anxiety.

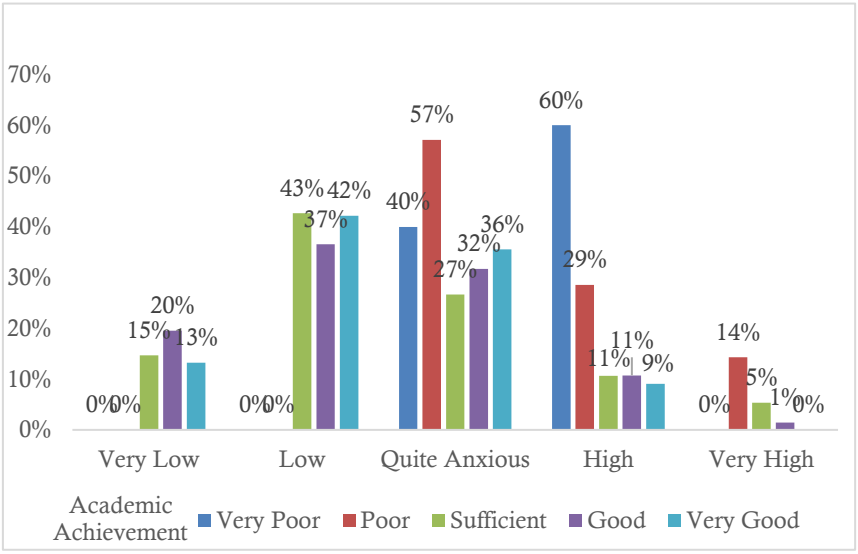

Figure 1. Classification of Chemistry Learning Anxiety based on Academic Achievement Level

Anxiety about studying chemistry can also be influenced by gender differences. Female students tend to be more anxious than male students. This is following the results of the analysis in Figure 2. Figure 2 shows that the percentage of male students' chemistry learning anxiety is predominantly in the low and very low categories. Meanwhile, female students' anxiety about studying chemistry is dominant in the quite anxious and high categories.

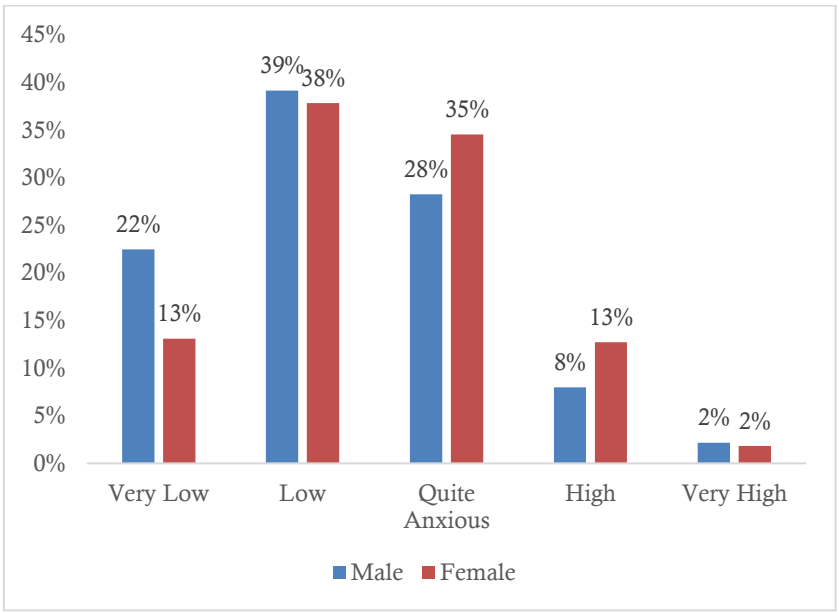

Figure 2. Classification of Chemistry Learning Anxiety based on Gender

Discussion

This section provides a discussion of the findings of this research. The research results showed that students did not experience anxiety or comfort in following the phase E chemistry learning process in class even though the new independent curriculum was implemented in tenth-grade of public senior high schools in Sleman Regency in the 2023/2024 academic year. This is because students who experience learning anxiety will have excessive fear, unstable emotions, discomfort, and even worry during the learning process when they are unable to understand and solve a problem in learning (Pangestika & Wiyarsi, 2021). Learning anxiety can affect students' mindset about their ability to participate in learning and complete assignments or tests at school. Therefore, students with low learning anxiety tend to be able to participate in learning well and can overcome existing problems.

However, the aspect of finishing chemistry task shows that some students experience anxiety. This is because this aspect puts pressure on individuals to want to have their work results assessed, such as when they take a chemistry test. The chemistry test is something that students worry about because that is when everything studied in phase E will be assessed, whether they have been able to understand the lesson well or not, and whether they have gotten good grades or not (Kaya & Yildirim, 2014). Students feel most anxious when they have to do chemistry questions on formulas, nomenclature, and chemical reaction equations. These results are in line with research by Johnstone (1974) which revealed that the concept of moles, chemical formulas, and chemical reaction equations were the most difficult topics to understand from a student's perspective. Apart from that, the material on the periodic system of elements and atomic structure is also material that is considered difficult by some students. The difficulties experienced by students when taking tests with these materials ultimately trigger anxiety about studying chemistry.

The second finding in this research shows that many students who have very good academic achievements are students who do not have learning anxiety. Meanwhile, students who have poor or even very poor academic achievement have anxiety about studying chemistry in the category ranging from moderately anxious to very anxious. This is following several studies that show that there is an inverse relationship between achievement and learning anxiety, meaning that students with high achievement have low anxiety and vice versa (Kaya & Yildirim, 2014). However, this research also found that some students who had good academic achievements had quite high levels of anxiety. These students felt that their anxiety did not significantly influence their performance in studying chemistry.

Apart from academic achievement, learning anxiety can also be influenced by gender differences. The research results show that female students tend to have higher anxiety than male students. These results are in line with research conducted by Amaliyah et al. (2021) and Woldeamanuel et al. (2013) which states that female students show higher anxiety toward learning chemistry than male students.

Learning anxiety is not something that is innate or something that is a fixed quality of an individual. Student learning anxiety can appear, increase, or decrease at any time. Therefore, students' chemistry learning anxiety conditions which are currently in the low category must continue to be maintained. Students must be continuously facilitated in increasing their understanding of chemistry and being introduced to chemistry laboratories so that they can obtain good academic achievements.

CONCLUSION

Based on this research, it can be concluded that students of public senior high school in Sleman Regency have a low category of chemistry learning anxiety in participating in phase E chemistry learning. Low chemistry learning anxiety is a good asset for students to be able to follow and understand chemistry learning well in phase E and the following phases. Male students and students with good academic achievement tend to have lower chemistry learning anxiety than female students and students with less good academic achievement.

ACKNOWLEDGEMENTS

The author is especially grateful to the supervisor and lecturers of the Scientific Publication course, Department of Chemistry Education, Yogyakarta State University, who have supported the implementation of this research. The author also would like to thank all school principals, chemistry teachers, and 10th grade students of public senior high schools in Sleman Regency.

REFERENCES

Abendorth, W., & Friedman, F. (1983). Anxiety reduction for beginning chemistry students. *Journal of Chemical Education*, *60*(1), 25-26. http://dx.doi.org/10.1021/ed060p25

Almarisi, A. (2023). Kelebihan dan kekurangan kurikulum merdeka pada pembelajaran sejarah dalam perspektif historis. *Jurnal Pendidikan, Sejarah, dan Ilmu-ilmu Sosial*, *7*(1), 111-117. https://doi.org/10.30743/mkd.v7i1.6291

Amaliyah, S., Suryaningsih, S., & Yunita, L. (2021). Gender differences in the relationship between anxiety, self-efficacy and students learning outcome on chemistry subject. *Edusains*, *13*(1), 8-14. http://doi.org/10.15408/es.v13i1.12991

Anwar, P. N., & Bhutta, S. M. (2014). Students attitude towards science in lower secondary classes: comparison across regions. *Journal of Educational Research*, *17*(1), 77-90.

Azwar, S. (2015). *Penyusunan skala psikologi*. Pustaka Pelajar.

Badjeber, R., Suciati, I., & Manaf, A. (2023). Kecemasan matematis siswa dalam penerapan pembelajaran matematika pada kurikulum merdeka belajar. *Koordinat Jurnal Pembelajaran Matematika dan Sains*, *4*(1), 21-29. https://doi.org/10.24239/koordinat.v4i1.55

Eddy, R. M. (2000). Chemophobia in the college classroom: Extent, sources, and student characteristics. *Journal of Chemical Education*, *77*(4), 514. http://dx.doi.org/10.1021/ed077p514

Erdem, E. (2012). Examination on of the effects of project based learning approach on students attitudes towards chemistry and test anxiety. *Wolrd Applied Sciences Journal*, *17* (6), 764-769.

Gillespie, R. J. (1997). Reforming the general chemistry textbook. *Journal of Chemical Education*, *74*(5), 484–485.

Gliem, J. A., & Gliem, R. R. (2003, October). Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for Likert-type scales. In *Midwest research-to-practice conference in adult, continuing, and community education*, 1, 82-87.

Huey, C. C. S. (2013). Assessment of chemistry anxiety among college students. *Chemistry Education and Sustainability in The Global Age*, 27-34. http://dx.doi.org/10.1007/978-94-007-4860-6_3

Jegede, S.A. (2007). Students anxiety toward the learning of chemist some Nigerian secondary schools. *Educational Research and Review*, *2*(7), 193- 197.

Johnstone, A.H. (1974). Evaluation of chemistry syllabuses in Scotland. *Studies in Science Education*, *1*(1), 21-49. https://doi.org/10.1080/03057267408559806

Kaya, E., & Yıldırım, A. (2014). Science anxiety among failing students. *Elementary Education Online*, *13*(2), 518-525.

McCarthy, W. C., & Widanski, B. B. (2009). Assessment of chemistry anxiety in a twoyear college. *Journal of Chemical Education*, *86*(12), 1447-1449. https://doi.org/10.1021/ed086p1447

Musta, R. (2023). Pengembangan lembar kerja peserta didik berbasis inkuiri terbimbing untuk meningkatkan hasil belajar siswa pada materi koloid. *Jurnal Pendidikan Kimia FKIP Universitas Halu Oleo*, *8*(1), 47–58. https://doi.org/10.36709/jpkim.v8i1.7

Pangestika, W., & Wiyarsi, A. (2021, March). Chemistry learning anxiety scale: a scale development. In *6th International Seminar on Science Education* (ISSE 2020) (pp. 241-247). Atlantis Press.

Rahayu, R., Rosita, R., Rahayuningsih, Y. S., Hernawan, A. H., & Prihantini, P. (2022). Implementasi kurikulum merdeka belajar di sekolah penggerak. *Jurnal Basicedu*, *6*(4), 6313-6319. https://dx.doi.org/10.31004/basicedu.v6i4.3237

Ristiyani, E., & Bahriah, E. S. (2016). Analisis kesulitan belajar kimia siswa di SMAN X kota tangerang selatan. *Jurnal Penelitian dan Pembelajaran IPA*, *2*(1), 18-29. https://doi.org/10.30870/jppi.v2i1.431.

Senocak, E., & Baloglu, M. (2014). The adaptation and preliminary psychometric properties of the Derived Chemistry Anxiety Rating Scale. *Chemistry Education Research and Practice*, *15*(4), 800-806. https://doi.org/10.1039/C4RP00073K

Sirhan, G. (2007). Learning difficulties in chemistry: An overview. *Journal of Turkish Science Education*, *4*(2), 4-20. https://dspace.alquds.edu/handle/20.500.12213/742

Suryani, N., Muspawi, M., & Aprillitzavivayarti, A. (2023). Implementasi kurikulum merdeka belajar di sekolah penggerak. *Jurnal Ilmiah Universitas Batanghari Jambi,* *23*(1), 773-779. http://dx.doi.org/10.33087/jiubj.v23i1.3291

Taber, K. S. (2009). Challenging misconceptions in the chemistry classroom: resources to support teachers. *Educació química*, *4*(1), 13-20. http://dx.doi.org/10.2436/20.2003.02.27

Woldeamanuel, M., Atagana, H., & Engida, T. (2013). Students' anxiety towards the learning of chemistry in some Ethiopian universities. *African Journal of Chemical Education*, *3*(2), 28-38

Yani, S. H., & Yerimadesi, Y. (2023). Validitas dan praktikalitas modul reaksi kimia berbasis guided discovery learning terintegrasi etnosains untuk fase E SMA. *Jurnal Pendidikan Mipa*, *13*(2), 436-444. https://doi.org/10.37630/jpm.v13i2.986

Yulika, H., & Hardeli, H. (2023). Pengembangan LKPD hukum dasar kimia berbasis model guided inquiry learning untuk peserta didik fase E kurikulum merdeka. *JURNAL PENDIDIKAN MIPA*, *13*(4), 1146-1152. https://doi.org/10.37630/jpm.v13i4.1349