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Enhancing Student Competence Through SETS-Based Chemistry Instruction on the Colligative Properties of Solutions

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Abstract
The purpose of this study was to determine the achievement of cognitive competence related to SETS on the subject of Colligative Properties of Solutions from visionary learning and the SETS approach of class XII students. To increase the achievement of students' affective achievement in the material of Colligative Properties of Solutions after learning through SETS visionary chemistry learning for class XII students. This research is an experimental study with the aim of knowing the SETS (Science, Environment, Technology and Society) vision of chemistry learning on student learning outcomes. The design used was "Randomized Control Group Pretest Posttest Design. The results of the study were differences in the differences that occurred in learning outcomes in the control class using the conventional model and learning outcomes in the experimental class. In the experimental class there was an increase in classical learning outcomes of 69.50%, while in the control class there was only an increase of 54.76%. So it can be concluded that the use of the model is more effective by 14.74% than the use of the conventional model. The conclusion is that there is a significant influence in the application of SETS Visionary Chemistry Learning on the Colligative Properties of Solutions on the Achievement of Cognitive and Affective Competencies.

Introduction

The development of science and technology is growing rapidly. One key to this development is education. In the life of a nation, education plays a crucial role in ensuring its growth and survival. Likewise, in Indonesia, gradual and continuous development is expected to positively impact development and progress in all fields (Ulfah et al., 2020). Therefore, education requires intensive attention, management, and prioritization from the government, society, and education administrators (Setianingsih, 2023). Lecture-based learning is no longer appropriate because it involves teachers merely transferring knowledge to students.

This method has historically been used as a means of verbal communication between teachers and students in educational interactions (Amdayani et al., 2022). This method demands more active participation from the teacher than from the students (Nurkhasanah et al., 2022). The use of monotonous learning methods (lectures) can lead to students becoming sleepy and lacking in attention due to the boredom (Kasi et al., 2021). Learning models must be able to transform students' learning styles from passive learners to active learners who construct concepts (Sylviana et al., 2019).

In this increasingly complex modern life, the involvement of science and technology and their impact on the environment and society are becoming increasingly inseparable from human life (Setianingsih, 2023). In today's world of education, the SETS (Science, Environment, Technology and Society) Approach is known or in Indonesian the term *SaLingTeMas* stands for Science, Environment, Technology and Society Rini, (Maimunah, 2022). From the SETS acronym, it can be seen that education with the SETS vision will cover topics and concepts related to science, environment, technology and matters related to society. The core objective of SETS education is for this education to enable students to understand the main elements of SETS and the relationships between these elements when studying science. In other words, critical thinking is needed to learn each element of SETS by paying attention to the various relationships between the elements of SETS (Rosdiana & Surya, 2022). Chemistry is a new subject that is taught comprehensively in high school. This is an opportunity for chemistry teachers to provide a good first impression of chemistry lessons. According to Prayitno, Dewi, & Wijayati,(Hadisaputra et al., 2023) first impressions are very important. If you are told that your new lecturer is strict and does not like criticism, you will be careful in asking questions. If we have a good impression of someone's character, we will find it easier to interact with that person. Likewise, if students already have a good impression of a subject, they will find it easier to follow the learning process. In the official KBK documents from the 2013 Curriculum Center, the vision and approach of SETS (Science, Environment, Technology, and Society) or SALINGTEMAS (Science, Technology, Environment and Society) is one of the recommended approaches in the science teaching and learning process at the secondary education level (Dwi Laksono & Firmansyah, 2020). In the process of learning chemistry in high school, teachers tend to emphasize subject matter or pure science without linking the science being studied with the environment, technology and society as a whole (integrated) (Hadisaputra et al., 2023). In addition, learning is generally only oriented towards completing everything with the realities of everyday life, as a result, students lack the ability to view subject matter or science as a whole that is most closely related to the environment, technology and society. The SETS vision is a forward-looking perspective that leads to an understanding that everything we face in this life contains aspects of science, environment, technology and society as a whole and influences each other reciprocally (Dwi Laksono & Firmansyah, 2020). Meanwhile, the SETS approach is a learning method by linking what is learned with aspects of science, environment, technology and society that are reciprocally appropriate as a form of integrated relationship (Suci et al., 2020). So in learning with the SETS vision and approach, students are invited to link the elements of science in the learning being followed with elements of the environment, technology and society (Maimunah, 2016).

Through SETS, students are expected to understand the implications of the relationship between SETS elements. The elements of SETS are Science, Environment, Technology, and Society. SETS will guide students to think actively and act to solve environmental problems or anything related to society. Research conducted by Aprianingtyas & Sumadi, (2016) at SMA 12 Semarang showed that the average learning outcomes of the Experimental class with SETS approach

learning were better, namely 74 compared to the non-SETS class which obtained an average learning outcome of 68. Another study conducted by Dianto at SMA Negeri 1 Ungaran showed that the chemistry learning outcomes of students in the experimental group using SETS got an average of 69 while the control class which obtained an average learning outcome of 68 without SETS 60. Meanwhile, Komariah et al at SMA 1 Kesatrian saw an increase in the learning outcomes of students taught with SETS from cycle I with an average learning outcome of 71 to 82 in cycle III (Aini et al., 2022). Chemistry is a subject that is part of science or science related to understanding concepts and formulas and solving problems. Currently, chemistry is still a subject that is difficult for students to understand. One of the chemistry subject materials that is useful in life is the colligative properties of solutions and those related to SETS elements are colligative properties. Students need to learn each concept of the four colligative properties through various reading sources, water phase diagrams, and other important information related to the colligative properties of solutions (Rahmawati et al., 2022). The material on the colligative properties of solutions does not only contain chemical concepts and theories, but also includes their application in everyday life. As one of the basic competencies that must be achieved by students in learning colligative properties is being able to present the results of information searches related to the application of the principles of colligative properties of solutions in everyday life (Widiantini et al., 2017). Based on these competencies, students are expected to be able to apply the concept of colligative properties of solutions to technological applications and their impact on the environment and the community environment so that students have broad insight. Based on the facts in the field, it turns out that many students of SMA Negeri 3 Pematangsiantar have difficulty in understanding the material on Colligative Properties of Solutions, as well as a lack of student competence in the material on Colligative Properties of Solutions (Prastika et al., 2024).

Based on the results of observations on the competencies of class XII MIPA students on the material of Colligative Properties of Solutions at SMA Negeri 3 Pematangsiantar see the learning completion categories that have been determined by the school are the category of scores > 65 with a total of 112 students and the percentage of classical completion is only 39%. Meanwhile, students with scores < 65 with a total of 175 students with a percentage of classical completion is only 61% and the total number of XII MIPA students is 287 with a percentage of classical completion of 100% (Source: Chemistry Teacher of SMA Negeri 3 Pematangsiantar) (Aisyah et al., 2021).

The above facts show that the chemistry competency of the Colligative Properties of Solutions material of grade XII students is still mostly low, namely 61% and is categorized as incomplete with KKM (Minimum Completion Criteria) 65. This encourages learning research using methods that can help overcome learning difficulties and can improve student competency in the above material, namely by using the application of the SETS vision of chemistry learning. It is hoped that the results of the study can make students' chemistry competency in the subject of Colligative Properties of Solutions more optimal and the learning model that researchers apply can be developed to be even better (Retno & Marlina, 2018a).

Method

The research subjects were students of class XII-MIPA in the even semester of SMA Negeri 3 Pematangsiantar. SMA Negeri 3 Pematangsiantar is located on Jalan Pane, Tomuan, East Siantar District, Pematangsiantar City. The population used in this study were students of class XII-MIPA of SMA Negeri 3 Pematangsiantar, consisting of 8 classes and an average number of students per class of 35 students. The sample determination in this study used a purposive sampling

technique, namely taking classes as samples with certain considerations (Widiastuti & Purnawijaya, 2021). The consideration in question was choosing classes whose students were active and communicative so that the implementation of the research would be effective so that the data obtained were maximized. The sample in this study were students of class X-MIPA semester 2 of SMA Negeri 3 Pematangsiantar, consisting of two classes, namely class XII-MIPA 3 as the experimental class and class XII-MIPA 5 as the control class.

This research is an experimental study aimed at determining the impact of SETS (Science, Environment, Technology, and Society)-based chemistry learning on student learning outcomes (Retno & Marlina, 2018b). The design used was a "Randomized Control Group Pretest Posttest Design" (Riwu et al., 2018). This design used two groups of subjects: one group as experimental class 1 and one group as the control class. For more details, the design can be seen in Table 3.

The steps taken in this research design are:

1. Give the T1 pretest to the experimental group and the control group to measure the average cognitive skills before the object is given treatment.
2. Providing treatment X1 in the form of using SETS vision chemistry learning in the experimental group and treatment X2 in the form of using conventional chemistry learning in the control group.
3. Providing a posttest covering cognitive and affective aspects T¬2 to the control group and experimental group to measure the average cognitive skills after being given treatment X1 and X2 (Wansaubun, 2020).
4. Determine the difference in values between T1 and T2 in the experimental group to measure the average difference in pretest-posttest values (Z1).
5. Determine the difference in values between T1 and T2 in the control group to measure the average difference in pretest-posttest values (Z2).
6. Compare Z1 and Z2 to determine any differences that may arise as a result of X1 treatment (Oladipo et al., 2022).
7. Apply the appropriate statistical test to determine whether the difference is significant, namely the right-tailed t-test.

Data and Data Collection Techniques

1. *Data Source*

In accordance with the research objectives, the data collected were student learning outcomes on the Colligative Properties of Solutions topic, obtained directly from students using an objective test. This test was administered before and after students took the Colligative Properties of Solutions topic, with the same questions for both the pretest and posttest. In addition, research was also conducted on the affective aspect (Chun Tie et al., 2019).

2. *Research Instruments*

The data from the variables studied were obtained from tests conducted by the researcher using cognitive and affective aspect instruments. The cognitive instruments were in the form of objective questions. To determine the validity, reliability, difficulty level of the questions and the discriminating power, the instrument to be used in this study needs to be tested first on a group of students who have received the Colligative Properties of Solutions material. The difficulty level of an item can be determined from the number of students who answered correctly. The difficulty level of an item is expressed in an index number called the Difficulty Index (IK), which is a number that is the result of the comparison between the correct answer obtained and the answer that should have been obtained from an item (Puspitasari & Nugroho, 2020).

Results and Discussion

Description of Research Results

Both the experimental and control classes received a Pre Test-Post Test to

determine the initial conditions of the sample. Researchers collected information about the process of implementing SETS-visioned Chemistry Learning on Colligative Properties towards Competency Achievement based on the learning that had been carried out on class XII students of SMA Negeri 3 Pematangsiantar. Many tests were carried out during the research process, including validity, reliability tests, question difficulty tests, and discrimination tests. This research is an experimental study with a pretest-posttest control group design conducted in class XII of SMA Negeri 3 Pematangsiantar. With class XII MIPA-3 as the experimental class with 35 students and class XII MIPA-5 as the control class with the same number of 34 students (Safitri, 2018). The distribution of questionnaires with Linkert scale provisions was carried out to see and measure student activities which were only distributed to the experimental class, namely class XII MIPA-3. The validation of each question or questionnaire that had been distributed was tested first, and SMA Bintang Timur Pematangsiantar which interviewed 36 people was the only school excluded from the study. This study was attended by 108 students, 72 of whom were validation participants, as well as 36 additional students.

In order to improve students' learning achievement on the colligative properties of solutions after learning through SETS-based chemistry learning for students, this study aims to determine the effect of SETS-based learning on the subject of colligative properties of solutions on the impressions that arise in students (Sims et al., 2021).

Prerequisite Test

Validity testing is a measure that indicates the level of validity of an instrument. Validity testing is conducted to determine whether the instrument used has a good level of suitability for the research objectives being conducted. The instrument used was 30 multiple-choice questions tested on 36 Grade XII students. After the questions were given to the students, the validity test was continued using SPSS Version 25 with the following validity criteria (Dassonneville & McAllister, 2018):

1. If r count > r table then the item is valid.
2. If r count < r table then the item is invalid

Table 1. Validity test analysis

No.	Pearson Correlation (R count)	R table	Significance Value	Information
1	0.472	0.329	0.004	Valid
2	0.579	0.329	0,000	Valid
3	0.098	0.329	0.568	Invalid
4	0.437	0.329	0.008	Valid
5	0,656	0,329	0,000	Valid
6	0,035	0,329	0,841	Invalid
7	0,501	0,329	0,002	Valid
8	0,471	0,329	0,004	Valid
9	0,448	0,329	0,006	Valid
10	0,418	0,329	0,011	Valid
11	0,705	0,329	0,000	Valid
12	0,521	0,329	0,001	Valid
13	0,424	0,329	0,010	Valid
14	0,142	0,329	0,410	Invalid
15	0,425	0,329	0,010	Valid
16	0,472	0,329	0,004	Valid
17	0,154	0,329	0,369	Invalid

18	0,441	0,329	0,007	Valid
19	0,507	0,329	0,002	Valid
20	0,080	0,329	0,642	Invalid
21	0,025	0,329	0,886	Invalid
22	0,534	0,329	0,001	Valid
23	0,423	0,329	0,010	Valid
24	0,389	0,329	0,019	Valid
25	0,042	0,329	0,807	Invalid
26	0,472	0,329	0,004	Valid
27	0,579	0,329	0,000	Valid
28	-0,034	0,329	0,845	Invalid
29	0,379	0,329	0,023	Valid
30	0.656	0.329	0,000	Valid

Based on the table, it was found that of the 25 questions tested, 8 were invalid and 22 were valid. The 20 valid questions will be used as research instruments in the pretest and posttest. Meanwhile, difficult questions will be discarded or eliminated because they do not meet the requirements. This can be seen directly from the comparison of the table r and calculated r, resulting in 20 questions being used in the pretest and posttest (Hák et al., 2016).

Reliability Test

Reliability testing is conducted after the validity test is completed. Reliability testing is used to assess the ability of the questions provided to reflect the reliability of the test. To determine this level of reliability, SPSS version 25 is used. The measurement criteria for an instrument are considered to have acceptable reliability if its test value (Cronbach's alpha) is 0.70 or higher. Based on the reliability test results shown in the table above, a Cronbach's alpha value of 0.861 was obtained, concluding that the instrument questions used have very high reliability (Sutrisno et al., 2020).

Test Question Difficulty

The difficulty test of the questions was conducted to see the level of difficulty of the instrument used. The difficulty test of the questions was based on the number of students who answered a question. The more who answered correctly, the easier the question can be said to be. In this difficulty test, the question will be carried out using the SPSS version 25 program which has been adjusted to the manual formula used (Metwaly et al., 2021). This measurement uses the question difficulty criteria index as follows: From the test carried out, it was found that in the instrument there were 9 questions with an easy level of difficulty, 10 questions with a medium level and 1 question with a difficult level, this can be seen directly from the SPSS results that have been described in the table (Buterin et al., 2024).

Differential Power Test

The discriminatory power test was conducted by examining each question item in terms of its ability to differentiate students who fall into the weak and strong achievement categories. The 20 questions were tested using SPSS version 25.

Descriptive Test of Cognitive Assessment

Descriptive testing is the activity of collecting, grouping, processing, analyzing, and presenting research data on a standardized research sample group that includes variance, standard deviation, average, range, minimum value, maximum value, median, and mean (Arghir, 2024). This descriptive test is conducted to fundamentally analyze the pretest and posttest data obtained from the experimental and control classes. In conducting the descriptive test, SPSS Version 25 software will be used with the following output results

Table 2. Descriptive Test of Cognitive Assessment

Statistics	Pre_Ex	Post_Ex	Pre_Control	Post_Control
Mean	50.88	84.85	51.57	77.71
Median	50.00	85.00	50.00	80.00
Fashion	45	85	50	80
Std. Deviation	8,022	7,636	7,648	7,984
Variance	64,349	58,311	58,487	63,739
Range	30	30	30	30
Minimum	35	70	35	65
Maximum	65	100	65	95
Sum	1730	2885	1805	2720

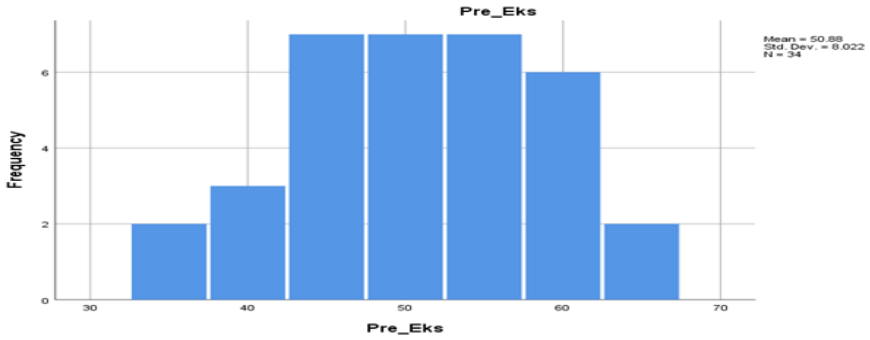

Figure 1. Histogram of Pretest and Posttest Experiment

data above can be seen in the experimental class in the pretest assessment that there were 2 students who got the lowest score, namely 35 and there were 2 students who got a score of 65. In the posttest histogram in the experimental class, there were 2 students who got the lowest score, namely 70, and there was 1 student who got the highest score, namely 100 (Sudarmin et al., 2020)

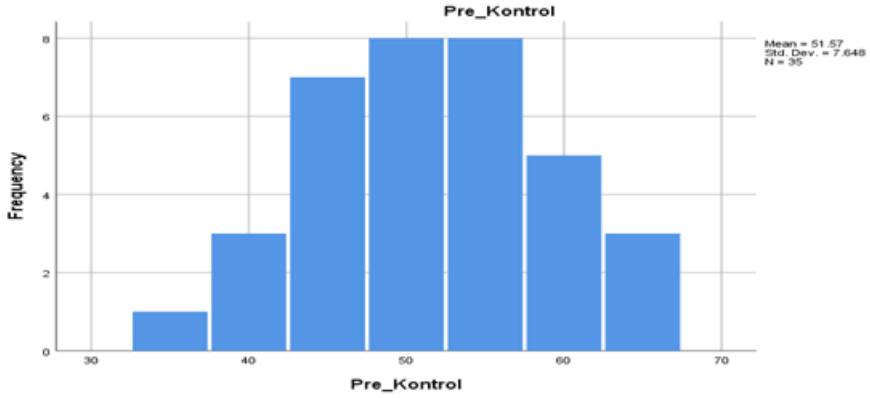

Figure 2. Histogram of Pretest and Posttest Control

Based on the histogram data above, it can be seen that in the experimental class in the pretest assessment there was 1. The student got the lowest score, namely 35, and there were 3 students who got a score of 65. In the posttest histogram in the experimental class, there were 4 students who got the lowest score, namely 65,

and there was 1 student who got the highest score, namely 95 (Warodiah et al., 2021).

Normality Test

The normality test aims to determine whether the sample data originates from a normally distributed population. Verification of normal post-test findings is carried out with the aim of identifying the type using statistical analysis. Good data suitable for use in this study is data with a normal distribution. The following are the test results with Liliefors' correction significance. If the significance value (sig) for all data is > 0.05, it can be concluded that the research data is normally distributed (Mulyanti et al., 2022). Because the data is normally distributed, it can be used for the homogeneity test. The basis for decision-making in this test is:

a. If the sig value > 0.05 then the data is normally distributed.
b. If the sig value is < 0.05 then the data is not normally distributed.

To make it easier to observe the significance of distributed datanormal, it can be seen in the following table (Azzajjad et al., 2021)

Table 3. Normality Test

Tests of Normality							
Class		Kolmogorov-Smirnov [a]			Shapiro-Wilk		
		Statistics	Df	Sig.	Statistics	df	Sig.
Results	1	0.137	34	0.104	0.953	34	0.150
	2	0.132	34	0.140	0.955	34	0.172
	3	0,130	35	0,142	0,956	35	0,169
	4	0,127	35	0,167	0,951	35	0,119

Based on the three normality tables, the significance value (sig) for the experimental class and the control class of the normality test using the "Kolmogorov - Smirnov" significance value of all existing data is > 0.05. So it can be concluded that the research data is normally distributed. To further facilitate the observation of the significance of normally distributed data, it can be observed with the histogram below. With the description of the two histogram images above, it helps the observation that shows that the data in the experimental class is normally distributed with a more curved assessment curve like a bell shape although not perfect. In contrast to the value data in the control class, which when observed shows an assessment curve that is not curved or not normally distributed (Hadisaputra et al., 2019).

Homogeneity Test

The homogeneity test is a statistical test procedure that aims to show that groups of sample data taken from a population have the same variance. Based on the data processing in the sample class above, each data significance value is > 0.05, it can be concluded that the data in the class is homogeneously distributed (Agustian et al., 2022).

The basis for making the decision is:

a. If the sig value > 0.05 then the data is homogeneous
b. If the sig value is < 0.05 then the data is not homogeneous

Table 4. Homogeneity Test

Test of Homogeneity of Variance					
		Levene Statistics	df1	df2	Sig.
Results	Based on Mean	0.292	1	67	0.591
	Based on Median	0.222	1	67	0.639
	Based on Median and with adjusted df	0.222	1	66,541	0.639
	Based on trimmed mean	0.318	1	67	0.575

Based on the table above, it is found that the significance value is more than 0.05, meaning that the data is homogeneous. To make it easier to observe the significance of normally distributed data, it can be observed using the histogram below.

Hypothesis Testing

After conducting normality and homogeneity tests in this study, the hypothesis testing was continued. Hypothesis testing is a decision-making method based on data analysis. After considering the characteristics of the variables studied and the analysis statements, the next step is to test the hypotheses using SPSS 25 (Chusnah et al., 2020). Based on the problem formulation and proposed hypotheses, the decision-making process will use a paired sample test to answer the proposed hypotheses.

T-test (Paired sample test)

The first hypothesis test uses a *paired sample test* . This test is conducted to compare results within the same class (the same sample), namely the pretest and posttest learning outcomes in the experimental class using the model. It is used to determine whether there is a difference in the average of the two paired samples. In SPSS version 25, the basis for decision-making is as follows:

a. If sig (2-tailed) < 0.05, then there is a significant difference between the pretest and posttest scores.
b. if sig (2-tailed) > 0.05, then there is no significant difference between the pretest and posttest scores

Table 5. Hypothesis Test (Paired Sample Test)

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	Interval of the Lower	Upper			
Pair 1	Post_Eks - Pre_Eks	33,971	7,956	1,364	31,195	36,747	24,896	33	0,000
Pair 2	Post_Kontrol - Pre_Kontrol	26,143	5,699	0,963	24,185	28,101	27,138	34	0,000

In the SPSS version 25 output above, the sig value (2-tailed) is 0.000 < 0.05, indicating that there is a significant difference between the pretest and posttest scores. In this case, Ho is rejected and Ha is accepted.

T test (independent sample test)

For the next t-test, *an independent sample test will be used.* This is because the second problem formulation is to compare two unpaired data sets (data from different samples) (Sitompul et al., 2024). The

independent sample test is used to see how two different methods affect learning outcomes. In this case, posttest scores in the experimental and control classes will be compared (Simaremare et al., 2022). This is based on the proposed hypothesis, which is to compare the average scores in different classes, namely the experimental and control classes. In this test, SPSS version 25 was used with decision-making,

a. If the sig(2-tailed) value is < 0.05 then there is a significant difference between the experimental and control classes.
b. If the sig(2-tailed) value > 0.05 then there is no significant difference between the experimental and control classes.

Table 6. Independent sample test

Independent Samples Test										
		Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Interval of the Lower	Interval of the Upper
Hasil	Equal variances assumed	0,292	0,591	3,794	67	0,000	7,139	1,882	3,383	10,895
	Equal variances not assumed			3,796	66,985	0,000	7,139	1,880	3,385	10,892

Based on the SPSS output above, it was found that the sig value (2-tailed) was 0.00 < 0.05, indicating a significant difference. In this case, Ho is rejected and Ha is accepted (Chusnah et al., 2020).

N-Gain Test

N-gain is used to assess the effectiveness of a method. The gain score is the difference between the pretest and posttest scores. Normal gain testing measures the average percentage increase in learning outcomes. This n-gain test uses SPSS v25

Table 7. N-Gain Percent

Statistics	Experiment	Control
N-Gain Percent	69.50%	54.76%

The SPSS Version 25 output table above shows the difference in learning outcomes between the control class using the conventional model and the experimental class. In the experimental class, there was a 69.50% increase in classical learning outcomes, while in the control class, there was only a 54.76% increase. Therefore, it can be concluded that the use of the model was 14.74% more effective than the conventional model (Zahid Iqbal & Campbell, 2023).

Discussion

The chemistry learning outcomes of students who participated in the implementation of SETS-based chemistry learning had better learning outcomes because the learning activities were carried out based on group discussions (Pitnelly et al., 2021). In the learning process, all group members were involved in solving problems given by the teacher. This is in line with research conducted by Sukmayasa et al. (2013), one of whose research results showed that the learning activities of students taught using the SETS-based chemistry learning were higher than

those taught using conventional learning (Abdurrahman et al., 2020).

The results of this study indicate the success of the application of SETS-based chemistry learning on the colligative properties of solutions to the achievement of grade XII students' competencies at SMA Negeri 3 Pematangsiantar (Andiko et al., 2021). This success is proven by the increase in student learning outcomes with the criteria of being quite effective with a value of 69.50% in the experimental class, while the control class only saw an increase of 54.76%. So it can be concluded that the use of SETS-based chemistry learning is more effective by 14.74% compared to the use of conventional models (Chang & Chang, 2021).

Research by Yoruk, Morgil, and Secken in the publication The Effect of Science, Technology, Society, and Environment (SETS) Interactions on Teaching Chemistry found that the SETS approach can be effective in teaching chemistry is considered an effective teaching strategy for students with increased motivation levels as research on the achievements of the experimental group. Science is not only the mastery of a collection of information in the form of principles, concepts, or facts, not only theories but also methods of inquiry.

A person's learning outcomes can be influenced by various factors, including internal factors, both the environment and the students themselves (internal and external influences) (Ramandanti, 2020). One of the SETS-visioned science learning approaches, which employs small groups with a large number of participants, is one of the internal elements. Each heterogeneous group consisting of 4-5 students requires cooperation from students and is responsible for the group's performance in achieving its predetermined learning objectives. When using a traditional teaching and learning model where learning is concentrated on lectures or explanations of teachers (teacher-centered). Of course, learning will be centered on the instructor, impacting students' reluctance to actively participate in their education, resulting in low student learning interest (Fibonacci et al., 2021).

Several previous studies conducted by several experts include, Research conducted by Amrullah et al., (Malmia et al., 2019) with the title "Development of Integrated Chemistry Module for Character Education with SETS Vision". The purpose of this study is With the concept of SETS character education on solubility skills and solubility products, this project intends to create an integrated chemistry module that is possible, useful, and efficient (Jackson & Hurst, 2021). The results of this study are For all sub-chapters, the module's practicality assessment scored 14.8 (92.5%). The module's effectiveness was 88.5% reviewed from students' classical completeness, and the N-gain test results were 0.6166. (moderate). The results of the study concluded that the module built is possible, useful, and efficient to use based on the data received. This is in accordance with the research of Arina Dwi & Rilia (Agustina et al., 2020) which found that the use of colloidal materials by considering science, environment, technology, and society can improve student learning outcomes. The application of the Advanced Organizer learning paradigm with the SETS (Science, Environment, Technology, and Society) vision has been proven to increase mastery of chemistry concepts by 4%, according to research by Wismaningati et al., (Dewi, 2021) In addition, research by Mursalin (Mellyzar et al., 2022) shows that learning materials with the SETS vision can improve academic performance (Reyes et al., 2022). Based on the results of the pretest and posttest, overall learning outcomes of students in grades XI IPA 3 and XI IPA 4 have increased, indicating the effectiveness of the teaching materials created (Mekwong & Chamrat, 2021).

Based on the presentation of the results of previous research and the research obtained, there is an influence of the Application of SETS Vision Chemistry Learning on the Colligative Properties of Solutions Material on the Achievement of Student Competencies and there is an increase in the achievement of

cognitive and affective competencies in Class XII students of SMA Negeri 3 Pematangsiantar

Conclusion

Based on the results and discussion, it can be concluded that there is a significant influence in the Application of SETS Visioned Chemistry Learning on the Colligative Properties of Solutions Material on the Achievement of Cognitive and Affective Competence. This result is proven by an increase in the achievement of students' cognitive competence where in the pretest assessment there were 2 students who got the lowest score of 35 and there were 2 students who got a score of 65, while in the posttest in the experimental class there were 2 students who got the lowest score of 70, and there were 4 students who got the highest score of 95. There was also an increase in the results of students' affective competence achievement where in the experimental class there was an increase in classical learning outcomes of 69.50%, while in the control class there was only an increase of 54.76%. So, it can be concluded that the use of the model is more effective by 14.74% compared to the use of the conventional model.

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Author Contributions

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Conflicts of Interest

This research is conducted to provide information to the public regarding the research that has been conducted so that it can be used for educational purposes. in addition, this research is used by researchers for lecturer performance loads and accreditation needs of study programmes and institutions

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