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Article

Method The Influence of Self-Efficacy and Learning Independence of Students on Chemistry Learning Achievement: Case Study State of 10th Grade Senior High School in Public High School 15 Pekanbaru

Ayu Rahmawati Putri[1], Lenny Anwar[2*], Rasmiwetti[3], Yesi Nursofia[4]

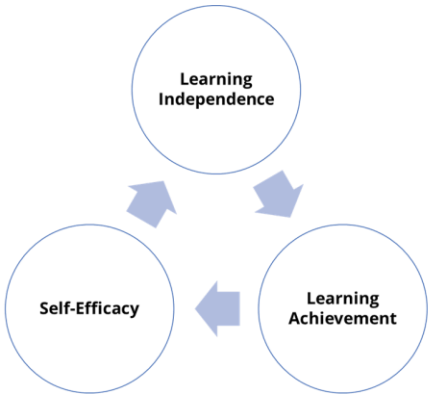
[1,2,3] Faculty of Teacher Training and Education, Chemical Education, University of Riau, Pekanbaru-28293, Indonesia
[4]College of Pharmacy, Taipe Medical University, No. 291, New Taipei City 23561, Taiwan

Abstract

Self-efficacy and learning independence are important factors in improving chemistry learning achievement and these factors must be mastered by students. This study aims to determine the effect of self-efficacy and learning independence on chemistry learning achievement partially or simultaneously. This type of research is a survey-research with a quantitative approach. The data collection methods for this study are questionnaires and documentation. The self-efficacy and learning independence questionnaires used were 21 questions after being validated. The questionnaires were distributed to all samples of 119 students taken using the simple random sampling technique. Documentation was used to collect data on chemistry learning achievement scores. Data analysis used in this study was multiple linear regression analysis. The results of the study showed (1) There is a positive and significant effect of self-efficacy partially on chemistry learning achievement, (2) there is a positive and significant effect of learning independence on learning achievement, (3) There is a positive and significant effect between self-efficacy and learning independence simultaneously on chemistry learning achievement.

Keywords: *Learning Achievement, Learning Independence, Self-Efficacy*

Graphical Abstract



Independent Sample Test Results

Variable	Sex	N	Mean	Std. Deviation	F	T	Df	Sig. (2-tailed)
Self-efficacy	Male	45	59.33	7.845	0.607	-0.959	117	0.339
	Female	74	60.68	7.120				
Learning Independence	Male	45	61.53	6.384	0.221	-0.670	117	0.504
	Female	74	62.35	6.501				
Learning Achievement	Male	45	77.51	8.075	0.148	-1.325	117	0.188
	Female	74	79.54	8.116				

* Corresponding author
Email addresses: lenny.anwar@lecturer.unri.ac.id

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Introduction

Education continues to develop and is very important for life. Through education, it can create competent human resources (HR). The formation of quality HR is supported by several supporting factors and cannot be separated from the guidance of educators, so that the success of the implementation of education is achieved. In addition, the success of education can also be achieved through improving the quality of education[1]. The quality of education plays an important role in forming quality individuals with noble character. Improving the quality of education can develop individual skills and become a measuring tool in the success of the learning process. The creation of students who are rich in potential within themselves will bring changes to the quality of education in the future[2].

Educational success can be seen from the learning achievements achieved by students who have reached the target. One of the indicators used to measure learning success is learning outcomes that refer to an achievement. Student learning success can be seen from the value obtained after completing a task or learning, so that student abilities can be measured from the scores received for each learning[3]. As for learning chemistry, it is abstract and requires self-confidence in understanding the material, so that learning chemistry is less popular with students. This is because students find it difficult to understand and lack motivation to learn chemistry. Therefore, not a few students get low learning achievement results[4]. A difficult chemistry learning requires educators to be more creative in choosing interesting learning methods so that students' curiosity arises during learning and can improve students' learning achievement. In addition to conducive learning to understand chemistry material, students need to have important factors within themselves to improve learning achievement, namely self-confidence (self-efficacy).

Self-efficacy is a belief in an individual in terms of motivating themselves, making changes in themselves, adapting themselves to the social environment and implementing the knowledge that has been mastered to carry out a task. Individuals who have high self-efficacy tend to choose more challenging jobs, complete many tasks, do not give up easily so that they get good academic results. While individuals who have low self-efficacy will feel low self-confidence and give up easily.[5]. The actions taken by students when they have low self-efficacy are postponing the completion of tasks given by the teacher. This treatment causes high academic procrastination and means having low self-efficacy. Academic procrastination is also often done intentionally by postponing work. So teachers are expected to always carry out maximum supervision during the learning process [6].

In addition to having high self-efficacy, there are other important factors to improve student learning achievement, namely learning independence. Learning independence is the ability of a student who wants to be independent in exploring information while learning. This independence emphasizes the active role of students in learning and being responsible for their learning success. Students who have strong learning independence will not give up easily. Learning independently does not necesserily learning individually, rather than a way of learning that emphasizes the independence of students in obtaining information and knowledge that does not depend on others [7].

In reality, in the chemistry learning process, educators tend to be more active than students. The cause of low student learning independence is because they are accustomed to receiving material and always depending on the teacher. Therefore, teachers try to guide students into independent learning process[8]. Several relevant studies state that self-efficacy and learning independence can improve learning outcomes, one of which is a study conducted by Chairunnisa *et al*. (2021) with research results showing that self-efficacy partially has a significant effect on cognitive learning outcomes, learning independence has a partial positive effect on cognitive learning outcomes, and there is a positive influence of self-efficacy and learning independence simultaneously on the cognitive learning outcomes of 11th natural sicences grade students on the material on ion equilibrium in salt solutions[9].

Based on the results of observations and interviews with chemistry teachers in 10th grade of Public High School 15 Pekanbaru, there are several problems faced during the chemistry learning process, namely that more than 50% of students' learning achievements have exceeded the set standards, but during the teaching and learning process they still find it difficult to understand chemistry material, actions taken by students such as still being hesitant in answering teacher questions, often ignoring material notes and even not doing chemistry assignments individually. Related to this description, it is necessary to make updates related to self-efficacy and learning independence to help educators in guiding students in improving learning achievement based on these important factors

Material and Methods

Materials and Instrumentation

The type of research used is survey research using descriptive methods with a quantitative approach. Data acquisition is done by answering a series of questions designed in a questionnaire then filled in by all predetermined samples. The source of the data population is 168 students divided into 5 classes, with the number of samples used in the study as many as 119 students of 10th grade of Public High School 15 Pekanbaru. In this study, two research variables were used, namely two independent variables consisting of self-efficacy (X_1) and learning independence (X_2) and one dependent variable, namely chemistry learning achievement (Y). The data analysis technique used is multiple linear regression analysis.

In this study, validity and reliability tests of the instrument were conducted using the SPSS version 16 program. Validity tests were conducted using the product moment correlation formula, while reliability tests used the Cronbach Alpha method. The results of the validity test showed that 21 items in the self-efficacy questionnaire and 21 items in the learning independence questionnaire were declared valid. The results of the reliability test showed that the Cronbach`s alpha value of self-efficacy was 0.851 and learning independence was 0.816 so it can be concluded that the research instrument used is reliable and can be used in research

Results and Discussions

The results of the descriptive statistical analysis including the average value (mean) and standard deviation based on student respondents are presented in Table 1. Table 1 shows that the level of self-efficacy and learning independence of 10th grade students of Public High School 15 Pekanbaru tends to be in the high category, while chemistry learning achievement tends to be in the good category.

Table 1. Descriptive Analysis Results

	N	Mean	Category	SD
Self-efficacy	119	60.17	High	7.398
Learning independence	119	62.04	High	6.442
Learning achievement	119	78.84	Good	8.219

Table 2. Normality and Homogenity

One-Sample Kolmogorov-Smirnov Test			
	Self-efficacy	Learning Independence	Learning achievement
N	119	119	119
Asymp. Sig (2-tailed)	.629	.442	.064

Classic Assumption Test: The classical assumption test in this study is include Normallity and Homogenity test. Table 2 shows that the Asymp. Sig (2-tailed) value > 0.05, which means that each research variable is normally distributed.

Multicollinearity test: In Table 3, it can be seen that the independent variables (self-efficacy and learning independence) have the same results, namely a tolerance value of 0.608 > 0.10 and a VIF value of 1.646 < 10, which can be concluded that the data is free from multicollinearity.

Table 3. Multicollinearity

Coefficients			
Model		Collinearity Statistics	
		Tolerance	VIF
1	Self-efficacy	0.608	1.646
	Learning independence	0.608	1.646

Hypothesis testing

Analysis of sex differences: Differential tests were conducted on the sex of students which were related to self-efficacy and learning independence based on student responses presented in Table 4. Table 4 shows that the significance value of the variables self-efficacy, learning independence, and learning achievement is > 0.05, which indicates that there is no significant difference based on the sex demographics.

Analysis of the influence of self-efficacy on learning achievement

Before conducting a regression test to determine the effect of self-efficacy on chemistry learning achievement, a linearity test needs to be conducted. The results of the linearity test obtained a significance value of deviation from linearity of 0.067> 0.05. It can be concluded that there is a linear relationship between the self-efficacy variable and the chemistry learning achievement variable.

Furthermore, a regression test of self-efficacy on student learning achievement was conducted on chemistry learning achievement, the results are presented in Table 5.

Table 5 shows that the constant value (α) is 50.718, meaning that if self-efficacy is equal to zero, then the students' chemistry learning achievement is 50.718. The regression coefficient value (b) is 0.466 and has a positive sign, meaning that for every 1 unit increase in self-efficacy, there is an increase in chemistry learning achievement of 0.466. So that the regression equation becomes $\mathbf{Y = 50.718 + 0.466X_1}$.

The significance value obtained is 0.000 < 0.05 with a t count value of 5.071 which means it is greater than t table of 1.657. So, it can be concluded that the self-efficacy variable has a significant effect on chemistry learning achievement.

Table 4. Independent Sample Test Results

Variable	Sex	N	Mean	Std. Deviation	F	T	Df	Sig. (2-tailed)
Self-efficacy	Male	45	59.33	7.845	0.607	-0.959	117	0.339
	Female	74	60.68	7.120				
Learning Independence	Male	45	61.53	6.384	0.221	-0.670	117	0.504
	Female	74	62.35	6.501				
Learning Achievement	Male	45	77.51	8.075	0.148	-1.325	117	0.188
	Female	74	79.54	8.116				

Table 5. Partial Test Results of Self-Efficacy on Learning Achievement

Model		Unstandardized Coefficients		
		B	**t**	**Sig.**
1	(Constant)	50.718	9.100	.000
	Self-efficacy	.466	5.071	.000

Analysis of the influence of learning independence on learning achievement: In conducting a regression test, a linearity test must be conducted first to determine whether the learning independence variable has a linear relationship with the chemistry learning achievement variable. The results of the linearity test obtained a significance deviation from linearity value of 0.562> 0.05. It can be concluded that there is a linear relationship between the learning independence variable and the chemistry learning achievement variable. Furthermore, a regression test of learning independence and chemistry learning achievement was conducted. The results of the simple linear regression test are presented in Table 6.

Table 6. Partial Test Results of Learning Independence on Chemistry Learning Achievement

Model		Unstandardized Coefficients		
		B	**t**	**Sig.**
1	(Constant)	52.089	7.617	.000
	Learning independence	.430	3.923	.000

Table 6 shows that the constant value (α) is 52.089, meaning that if learning independence is equal to zero, then the students' chemistry learning achievement is 52.089. The regression coefficient value (b) is 0.430 and has a positive sign, meaning that for every 1 unit increase in learning independence, there is an increase in chemistry learning achievement of 0.430. so that the regression equation becomes $\boldsymbol{Y = 52.089 + 0.430X_2}$. The significance value obtained is 0.000 < 0.05 with a t count value of 3.923 which means it is greater than the t table of 1.657. The result shown that, the learning independence variable has a significant effect on chemistry learning achievement.

Analysis of the influence of self-efficacy and learning independence simultaneously on learning achievement

Multiple Linear Regression Test: In order to determine the magnitude of the influence of self-efficacy (X_1) and learning independence (X_2) on chemistry learning achievement (Y) using multiple linear regression analysis. The results of the analysis are presented in Table 7.

Table 7. Multiple Linear Regression Analysis Results

Coefficients						
		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
Model		B	Std. Error	Beta		
1	(constant)	46.167	6.827		6.762	.000
	Self-efficacy	.381	.118	.347	3.237	.002
	Learning independence	.156	.135	.123	1.151	.252

Table 7 shows that the constant value (α) is 46.167, meaning that if self-efficacy and learning independence in the research object are equal to zero (0), then the learning achievement (Y) of students is 46.167. The regression coefficient value (b_1) is 0.381 which is positive, meaning that there is a positive influence between self-efficacy (X_1) and learning achievement (Y). This means that the higher the self-efficacy value, the higher the learning achievement obtained. While the regression coefficient value (b_2) is 0.156 which is positive, meaning that there is a positive influence between learning independence (X_2) and learning achievement (Y). So that if the learning independence value is higher, the learning achievement will also be higher. So that the regression equation can be seen as follows:

$Y = 46{,}167 + 0{,}381X_1 + 0{,}156X_2$ ..... (1)

Simultaneous Test (F Test): The F test was conducted to determine whether the self-efficacy variable (X_1) and the learning independence variable (X_2) simultaneously influence students' learning achievement (Y). The results of the F test are presented in Table 8.

Table 8 shows that the significance value of 0.000 < 0.05 means that there is a significant influence on self-efficacy and learning independence simultaneously on chemistry learning achievement. The F_{count} value obtained was 13.557 which was compared to the F_{table} value. The F_{table} value can be found in the statistical table using a significance level of 5% with df_1 (number of variables) = k-1 = 3-1 = 2, and df_2 = n-k-1 = 119-2-1 = 116, so that the F_{table} value is 3.07. Therefore, the F_{count} value (13.557) > F_{table} (3.07) and it can be concluded that self-efficacy and learning independence have a simultaneous effect on chemistry learning achievement.

Table 8. F Test

ANOVA	
F	Sig
13.557	.000

Coefficient of Determination*:* The coefficient of determination test is used to measure how much a model is able to explain the variation of the dependent variable. The results of the calculation of the coefficient of determination can be seen in Table 9.

Table 9 shows that the coefficient of determination (R square) value is 0.189, which means that self-efficacy and learning independence as independent variables contribute together to student learning achievement in chemistry learning. The coefficient of determination (R^2) value is 0.189 or 18.9%, which means that the influence of self-efficacy and learning independence on learning achievement is 18.9 %, while the rest is influenced by other factors.

Table 9. Results of Determination Coefficient Test

Model Summary		
	R	R Square
Self-efficacy and learning independence	.435	.189
Self-efficacy	.424	.180
Learning independence	.341	.116

The coefficient of determination of the self-efficacy variable on chemistry learning achievement is 0.180. So that the self-efficacy variable contributes 18.0 % to chemistry learning achievement. The learning independence variable obtains a coefficient of determination of 0.116, which means that learning independence contributes 11.6 % to student learning achievement in chemistry learning.

The study was conducted to determine the effect of self-efficacy and learning independence on chemistry learning achievement of 10th grade at Public High School 15 Pekanbaru. There are three variables in this study, namely self-efficacy and learning independence as independent variables and learning achievement as dependent variables. The sample in the study was 119 students divided into 5 classes. Based on student

demographics, 37.8% were male and 62.2% were female, so there were more female students.

The results of the hypothesis testing on the self-efficacy variable showed no difference because it obtained a significance value of 0.339 > 0.05 based on sex. The proposed hypothesis was rejected, because there was no difference in the self-efficacy variable. In line with the research conducted by Safitri, it showed that there was no significant difference by obtaining a t-test value of 0.167 > 0.05. This means that sex does not have a major effect on self-efficacy in this study[10]. The research results (Table 5) show that females' self-efficacy is higher than males'.

The results of the hypothesis test of the learning independence variable showed no difference because it obtained a significance value of 0.504 > 0.05 based on sex. The proposed hypothesis was rejected, because male and female students did not differ in the learning independence variable. In line with research conducted by Fauzan, it showed that there was no difference between male and female students in online learning by obtaining a significance value of 0.162 > 0.05. This shows that there is no difference in independence between males and females[11]. The research results (Table 4) show that learning independence in female students is higher than in male students.

The results of the chemistry learning achievement hypothesis test showed no difference with a significance value of 0.188 > 0.05 based on sex. The proposed hypothesis is accepted because there is no difference in the learning achievement variable based on sex. In line with research conducted by Sari, it shows no significant difference in the learning outcomes of male and female students. Where they have an average of good learning outcomes or are equivalent to achieving the minimum completeness criteria that have been set [12].

Partial analysis results testing on the self-efficacy variable obtained that t_{count} value (5.071) > t_{table} (1.657) with a significance value of 0.000 < 0.05, so the proposed hypothesis is accepted. This means that self-efficacy partially influences learning achievement in chemistry learning with a determination coefficient value of 0.180 or 18.0%. The influence of good self-efficacy can produce learning achievement in chemistry learning that is categorized as moderate. Therefore, students continue to strive to produce satisfactory learning achievement. Students who have a moderate level of self-efficacy but some students have persistence in carrying out learning so that they do not give up easily and continue to try in carrying out academic activities [13]. Based on the research results that self-efficacy is a self-confidence in individuals to complete tasks and be able to overcome the obstacles they face. High self-efficacy will help students in following the learning process because they are able to face problems with self-confidence. Therefore, high self-efficacy affects students' learning achievement which is also good, and vice versa if students' self-efficacy is low then it will affect the learning achievement produced to become low [14].

Testing the partial analysis results of the learning independence variable obtained that t_{count} value (3.923) > t_{table} (1.657) with a significance value of 0.000 < 0.05, so the proposed hypothesis is accepted. This means that learning independence partially influences learning achievement in chemistry learning with a determination coefficient value of 0.116 or 11.6%. In line with research conducted by Widianti, it states that there is an influence between learning independence and learning achievement in Indonesian language subjects [15]. The same results were also obtained by Wirayat, namely the influence of learning independence on learning outcomes with a determination coefficient of 0.102 with an influence of 10.2% [16]. Based on the results of the research conducted, independent learning has a great influence on students' learning achievements, because it can be used to develop themselves to appear independently without the help of others [17]. Learning independence must also continue to be developed because the influence obtained is still in the moderate category, so that if the influence of learning independence increases, it can improve the learning achievements obtained by students during chemistry learning.

Simultaneous testing on the variables of self-efficacy and learning independence showed a positive and significant influence as seen through the F_{count} value (13.557) > F_{table} (3.07) with a significance value of 0.000 < 0.05, so the proposed hypothesis is accepted. This means that self-efficacy and learning independence simultaneously influence chemistry learning achievement with a determination coefficient value of 0.189 or 18.9%. The regression equation obtained is $\boldsymbol{Y} = \mathbf{46,167} + \mathbf{0,381}\boldsymbol{X}1 + \mathbf{0,156}\boldsymbol{X}_2$. Based on the resulting regression equation, the self-efficacy regression coefficient is 0.381 and the learning independence regression coefficient is 0.156. This means that the self-efficacy variable has a more dominant influence than learning independence on student learning achievement. The results of the study were strengthened by Rachman's research where there was a positive and significant relationship between the variables of self-efficacy and learning independence together with learning outcomes in biology subjects. The amount of contribution given by self-efficacy and learning independence to learning outcomes was 23.9% [18].

With the existence of self-efficacy and learning independence, it is very influential in improving students' chemistry learning achievement in chemistry learning [19,20]. In addition, it is an encouragement for teachers to continue to improve self-efficacy by honing their independence in the teaching and learning process. So that students are more courageous in speaking in class with various other actions to foster self-efficacy and independence in themselves

Conclusions

Self-efficacy in the form of students' self-confidence is able to improve learning achievement by continuing to be trained and developed within themselves, and self-efficacy can provide a positive and significant influence on chemistry learning achievement as evidenced by a significance value of 0.000. Student learning independence is carried out with the aim that students are able to carry out learning activities independently without relying on others, where learning independence can provide a positive and significant influence on chemistry learning achievement as evidenced by a significance value of 0.000. In addition to being partial, self-efficacy and learning independence can influence together as evidenced by a significance value of 0.000 and have a contribution of 18.9% which is influenced by the variables of self-efficacy and learning independence, and the rest is influenced by other factors that can improve learning achievement

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Author Contibutions

Conceptualization, A.R.P, L.A.; Methodology, A.R.P, L.A; Validation, L.A, R.R; Formal Analysis, A.R.P, L.A; Investigation, R.R; Data Curation, A.R.P, L.A, Y.N; Writing–Original Draft Preparation, A.R.P; Writing – Review & Editing, L.A, Y.N; Visualization, A.R.P; Supervision, L.A

Conflict of Interest

There are no significant conflicts

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