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The Influence of Computation Implementation in Chemistry BasicCourses on Chemistry-Biology Pre-Service Teachers of UIN SyekhAli Hasan Ahmad Addary Padangsidimpuan

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Abstract This study aims to determine the effect of the implementation of computation through the experimental test method on the skills of students majoring in Tadris Biology UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan 3rd semester. This type of research is experimental research with a pretest-posttest control group design. Sampling was carried out using the cluster random sampling technique. The population in this study were students of Tadris Biology at Uin Shahada Padangsidimpuan, with a sample of Tadris Biology students at UIN SYAHADA (experimental class) and Tadris Biology students at UIN SYAHADA Padangsidimpuan Semester 3 (control class). The instrument used was a process skill test in the form of reasoned multiple choice which was first tested for validity, and reliability. The results of the pretest homogeneity test showed the initial ability of the experimental class and homogeneous control, so the effect of the treatment was the result of the posttest. So, it can be concluded that there is an effect of computer-based learning through experimental methods on the influence of the implementation of computing in basic courses on students of Tadris Biology at UIN SYAHADA Padangsidimpuan.

1. Introduction

Chemistry has long been known as a field of science based on experiments. Because indeed all scientific explanations presented are always based on experimental results. In the sense that chemical understanding or new theories arise after observing the results of experiments. Similarly, in the field of physics, all new theories arise after observing the results of experiments. Along with the development of science, physics experienced a fairly rapid development. Many new theories were discovered, such as the discovery that particles can be like waves, or vice versa waves can be like particles, to the discovery of quantum mechanics, with its famous Schrodinger equation. equation

The resulting Schrodinger equation is at the heart of much of modern science. The simplest form of Schrodinger's equation is $\hat{H}|\Psi'=E|\Psi'$. All of the above discoveries only apply when a particle is small and has a small energy. Since then, the understanding of chemistry has not only occurred due to observations of experimental results but also the development of quantum mechanical theory, which is to predict the properties of an atom or molecule. However, solving quantum mechanical equations is not easy if only using a hand calculator. Along with the development of computer science, the capabilities of a computer can be utilized to solve quantum mechanical equations. This led to the birth of a new sub-field, namely computational chemistry which is part of theoretical chemistry. Computational chemistry is a branch of chemistry that uses the results of theoretical chemistry translated into a computer program to calculate the properties of molecules and their changes.

Computational chemistry can also simulate large systems (or many molecules of gaseous proteins, liquids, solids,

and liquid crystals), and apply the program to real chemical systems. Examples of molecular properties that are calculated include atomic structure, energy and energy difference, charge, dipole moment, reactivity, vibrational frequency and other spectroscopic quantities. Simulations of macromolecules (such as proteins and nucleic acids) and large systems can include the study of molecular conformations and changes (e.g. protein denaturation processes), phase changes, and the prediction of macroscopic properties (such as specific heat) based on behaviour at the atomic and molecular levels. The term computational chemistry is sometimes used also as computer science and chemistry. Therefore, computational chemists are required to be able to develop hardware and software to improve the ability of computers to solve chemical problems, as well as to be able to convert data from computer calculations into data that can be visualized (such as molecular shapes) so that it is more easily understood by other chemists.

The term theoretical chemistry can be defined as a mathematical description of chemistry, while computational chemistry is usually used when the mathematical methods are developed well enough to be used in a computer program. It should be noted that the words "precise" or "perfect" do not appear here, as very few aspects of chemistry can be calculated precisely. Almost all aspects of chemistry can be described in an approximate qualitative or quantitative computational scheme. Computational chemistry is now one of the fastest-growing fields in chemistry. Although there are specialists in this field, the application of its techniques by experimental chemists is increasing as the capabilities of the software, this field, the application of its techniques by experimental chemists increase as the capabilities and cheapness of computers increase. Computational chemical modelling can help chemists to: (1) Initially design the desired synthesis reaction process, (2) Study and explore possible reaction mechanisms from the design that has been made, (3) Perform reaction simulations in the computer, and (4) Determine the properties of the reagent molecules and the products produced.

2. Research Methodology

This type of research is experimental research, which is a research method used to find the effect of chemical computing implementation treatment. This research was conducted from November 2022 to December 2022, at Sheikh Ali Hasan Ahmad Addary State Islamic University. The focus of this research is the effect of computational implementation in basic chemistry courses on Tadris Biology students at UIN SYAHADA Padangsidimpuan. The learning process carried out is face-to-face based which is bound to the computational implementation skills of Tadris Biology students in semester 3. The control variables are material, learning objectives, instruments, time allocation and assessment methods. The research design uses a pretest-posttest control group design which aims to obtain differences in students' computational implementation skills between experimental and control classes so that in the end it will get the effect of the learning model used.

3. Result and Discussion

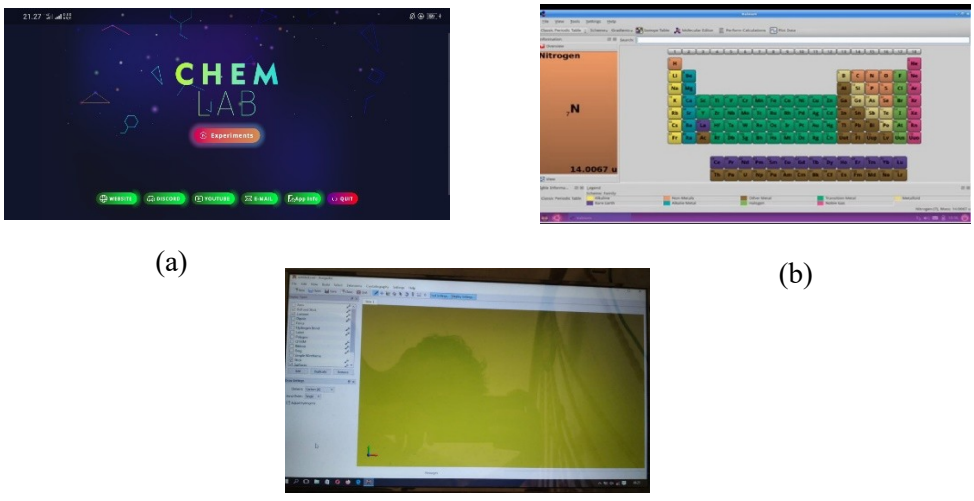
A lot of software has sprung up in this modern era as a form of technological and information development where scientists have found instruments that can be used in education and industry for their purposes. In this study, the software acts as a substitute for activities that usually require space, time and relatively large costs and can trigger water pollution if practicum waste that has the potential to have toxins into the river and can potentially pollute the soil and air. Some software is used for educational purposes as a bridge for basic chemistry practice in the chemistry laboratory of third-semester Tadris Biology students at the Faculty of Tarbiyah and Teacher Training Sciences, UIN SYAHADA. The review of this application is based on the ease of installing or installing the application, the ease of using the application and compatibility with basic chemistry materials. The following table shows the effectiveness of the application at UIN SYAHADA.

Tabel 1. Chemistry Computation Appliaction

Software Nama	Based	Ease of Instalation	Ease to Use	Final
Chem-lab	Android	V	5	Yes
Avogadro	Web	V	4	Yes
Kalzium	Web	X	2	Yes

Based on the table above, there are several application-based software that can be downloaded from Android phones or on PCs where the Chem lab application can be downloaded on Android while the Avogadro and Kalzium applications can be installed on PCs. After going through a selective review, two computing-based applications can be used perfectly, namely the Chem-lab and Avogadro applications. Where Avogadro was chosen because of its ease of installation and use and does not require internet access to operate this application. This application is suitable for chemical bonding materials, molecular shapes, and interactions between molecules. This Avogadro application can visualize the shape of the molecule perfectly and include other information about the molecule, one of which is information on the angle of the molecule, the number of masses, atomic numbers, reactivity and so on so that it is very efficient in its use. The Chem-lab application (see Figure 1a) is an application that can present moving objects in a virtual laboratory that can perform several processes in a basic chemistry practicum. This application was chosen because in addition to being easy to install and use this application also does not require internet access and already displays what steps must be taken so that users have no difficulty in operating this application. This application is suitable for mixture separation material where users can do distillation, chromatography, and centrifugation practicum.

The Kalzium application (see Figure 1b) is not used or eliminated due to the difficulty of installing this application on Windows because there are problems where this application must use other applications to support the Kalzium application to be used. In addition to being difficult to install this application is also difficult to operate so this application is eliminated.



(a) (b)

(c)

Figure 1. (a) Aplikasi Chem-Lab, (b) Aplikasi Kalzium, (c) Aplikasi Kalzium

After determining the appropriate topic, the next step is to develop a practicum following the existing software. It was found that topics such as chemical bonds, molecular shapes and interactions between molecules can be done using the Avogadro application (see Figure 1c) and the topic of mixture separation can be used with the Chem-Lab application.

The survey was also used to assess the effect of the learning outcomes of Tadris Biology study program students in the form of a description of the data obtained from the pretest and posttest using normality, homogeneity and hypothesis testing, while the pretest results of student learning values by giving question sheets on mixed separation material.

The results of the study are in the form of a description of data on student computational implementation skills from pretest and posttest using homogeneity test, normality test and hypothesis test (t-test polled variance with two-party test criteria). The pretest data of computational implementation skills in the experimental class and control class on computational chemistry material can be seen in Table 1 below:

Table 2. *Pretest Data on Both Sample Class*

Component	**Data on Student Chemistry Learning Results**	
	Experiment Class	**Control Class**
The number of students	20	20
The highest score	70	90
Lowest value	40	40
Average	56	64,25
Standard Deviation (SD)	18,58	14,01
Homogeneity Test	Homogen	

The pretest data showed that the average value of students' initial tests in both samples was 56 for the control class and 64.25 for the experimental class with an average difference of 8.25. Table 1, shows that the experimental and control classes are homogeneous, which means that the two sample classes have slightly different initial abilities of computational implementation process skills. Based on these results, the effect of the treatment was carried out by analyzing the post-test data.

After the pretest, the two sample classes were given different treatments, then the posttest was conducted. The posttest data of computational implementation skills in the experimental class and control class on temperature, heat, and heat transfer material can be seen in Table 2 below:

Table 3. *Posttest Data on Both Sample Class*

Component	**Data on Student Chemistry Learning Results**	
	Experiment Class	**Control Class**
Jumlah Siswa	20	20
Nilai Tertinggi	90	95
Nilai Terendah	65	50
Rata-Rata	75,5	76,5
Standar Deviasi (SD)	16,06	8,56
Uji Normalitas	Normal	Normal
Uji Homogenitas	Homogen	

Uji Hipotesis	$-t_{tabel} < t_{hitung} > +t_{tabel}$, H_0 ditolak dan H_a diterima

In Table 2. above, it can be seen that the average score of the experimental class after the posttest is also higher than the control class, namely the average score of the experimental class of 75.5 and the average score of the control class of 76.5 with an average difference that is greater than the pretest results, namely 0.1. Based on the posttest results, both experimental and control classes experienced an increase, which showed an increase in computational implementation skills. The experimental class experienced an increase in the average score of 19.5, while the control class experienced an increase of 12.25. The above results show that the increase in the average score experienced by the experimental class is higher than the increase in the average score of the control class.

Furthermore, the posttest results were analyzed to determine the effect of computer-based learning through the experimental method applied in the experimental class on computational implementation skills. Based on the results of the normality and homogeneity test of the post-test data, it shows that the data is normally distributed and homogeneous, so the effect of PBK through this experimental method is tested using a question test on the question sheet, then the test results above show the effect of PBK through the experimental method of giving questions to students majoring in Tadris Biology semester 3 to test the skills and abilities of Tadris biology students semester 3 UIN SYAHADA Padangsidimpuan in 2023.

To determine the level of influence of the PBK treatment through the experimental method on the skills and abilities of the problem-solving process by the sample, which is the difference from the pretest and posttest results, to know the level of ability of the entire sample after being provided with the material. The percentage increase in sample skills is grouped into three categories, namely low ($g < 30\%$), medium ($30\% \leq g < 70\%$), and high ($g \geq 70\%$).

Overall, the experimental class experienced an increase of 19.5%, which was included in the moderate category, while the control class experienced an increase of 12.25% which was included in the low category. When viewed per aspect of science process skills studied, the experimental class experienced a higher increase per aspect than the control class.

Data from the pretest and posttest results show that the experimental class experienced an increase in the process skills of selecting questions on the question sheet that were higher than the control class. The occurrence of this increase is an influence during learning. During the learning of mixture separation material, students conducted a test as many as 2 experiments. For each experiment carried out, students are required to fill out a question sheet. The questions used in the question sheet are basic questions on mixture separation material. Thus, in conducting experimental activities students carry out the problem-solving process in question-based learning. Indirectly the process trains skills in computational chemistry Tadris Biology students UIN SYAHADA Padangsidimpuan to be better.

The phenomenon shows that the experimental class is given a provision similar to the control class. problem-based learning with experimental methods provides an opportunity for students to solve a problem through a scientific thinking process that simultaneously trains their science process skills. problems can encourage the seriousness of curiosity. Students' curiosity about a problem is facilitated

by the same material. The results in this study also reinforce the theory that through problem-based learning students not only understand the concepts relevant to the problem that is the centre of attention but also gain learning experiences related to skills in problem-solving and foster critical thinking patterns. In addition, the use of the method of solving questions on the problem sheet in the process of problem-based learning provides opportunities for students to search and find their various answers to problems.

In addition, the use of the method of solving questions on the problem sheet in the process of problem-based learning provides opportunities for students to seek and find various answers to the problems they face by conducting their experiments through scientific thinking. The skill of applying the scientific method is what leads students to train other process skills.

The results of this study also corroborate previous studies. According to Rusnayati and Prima, this process skill is trained in students at the stage of writing down the work actions carried out in the syntax of the problem-based learning model. When the process is carried out by students, many process skills are trained for students.

4. Conclusion

In this study, the software acts as a substitute for activities that usually require space, time and relatively large costs and can trigger water pollution if practicum waste has the potential to have toxins into the river and can potentially pollute the soil and air. The pretest data showed that the average value of students' initial tests in both samples was 56 for the control class and 64.25 for the experimental class with an average difference of 8.25. Table 1, shows that the experimental and control classes are homogeneous, which means that the two sample classes have slightly different initial abilities of computational implementation process skills. Based on these results, the effect of the treatment was carried out by analyzing the post-test data. Based on the results of the normality and homogeneity test of the post-test data, it shows that the data is normally distributed and homogeneous, so the effect of PBM through this experimental method is tested using a question test on the question sheet, so the test results above show the effect of PBM through the experimental method of giving questions to students majoring in Tadris Biology semester 3 to test the skills and abilities of Tadris Biology students Semester 3 UIN SYAHADA Padangsidimpuan Year 2022. To determine the level of influence of computer-based learning treatment through experimental methods on the skills and abilities of the problem-solving process by the sample, which is the difference from the results of the pretest and posttest, to know the level of ability of the entire sample after being provided with material. learning material.

Problem-based learning with experimental methods provides an opportunity for students to solve a problem through a scientific thinking process that simultaneously trains their science process skills, problems can encourage seriousness of curiosity.

Students' curiosity about a problem is facilitated by the same material. The results in this study also further strengthen the theory that through problem-based learning students not only understand the concepts relevant to the problem that is the centre of attention but also gain learning experiences related to skills in problem-solving and foster critical thinking patterns.

In addition, the use of the method of solving questions on the problem sheet in the process of

problem-based learning provides opportunities for students to seek and find various answers to the problems they face by conducting their experiments through scientific thinking.

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