

# USE OF COMPUTER-BASED EDUCATIONAL MEDIA TO IMPROVE THE LEARNING ABILITY OF INDUSTRIAL ENGINEERING STUDENTS IN CHEMISTRY

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**ABSTRACT**-This study aims to determine differences in chemistry learning outcomes taught using computer-based media compared to conventional teaching on the Subject of Electrolyte and Non-Electrolyte Solutions. The research was conducted at Prima Indonesia University for the 2021/2022 Academic Year. The population of this study were all first-semester students consisting of two classes. A sample of 60 students, consisting of an experimental style and a control class, was given a different treatment, namely multimedia computer-based teaching with conventional media on the same subject. Based on data collection, the results obtained are that the experimental class has higher learning outcomes than the control class.

**Keywords:** Computers, Electrolyte Solutions, Non-Electrolytes

## 1. INTRODUCTION

Low learning outcomes are a common problem in national education, including chemistry education. Many factors influence the results of this study [6]. Because chemistry is a field that has many abstract concepts. Students prefer to avoid chemistry because it is abstract. This abstract nature causes a lack of student learning responses and a lack of feedback from lecturers. Computer-based multimedia teaching programs improve learning outcomes and reduce this abstract nature. With computer-based chemistry learning, it is expected that better learning outcomes will be achieved because computers can make abstract concepts of subject matter more real. In addition, many teachers still apply conventional learning models and approaches. In the traditional teaching approach, the lecturer is a transformer, motivator, and communicator. Students only receive lessons and become passive, and this is contrary to the idea that students must be active and have the ability and have individual potential.

Chemistry is a very exact field. Chemistry learning outcomes are not comparable to chemistry test scores. In the Odd Semester Final Examination (UAS) for the 2021/2022 Academic Year, the average chemistry score of Industrial Engineering students only reached 6.67, and during the Odd Semester Final Examination for the 2022/2023 Academic Year it was not much different, only achieving an average score of 6, 69.

Success is not maximized if it is not supported by media such as computers to understand chemistry learning, which is filled with the concept of calculation, the terminology of chemical elements, atomic groups, and so on, one of which is the difference between electrolytes and non-electrolyte solutions, media is needed. This material has concepts that students need help understanding. The press must be relevant to students' goals, materials, and characteristics so that learning is appropriate, effective, and fun for students [7]. Lecturers are the most appropriate educators to make media because they best understand the subject matter, goals,

and various things students can quickly understand. However, many lecturers make the press not right on target, so learning outcomes stay the same.

In-depth observations made by the author since 2017 show that using multimedia can improve student learning outcomes by 19.67 percent compared to not using media. This observation also found that student learning outcomes increased by 36.06 percent from 57.80 percent when using multimedia. In 2019, the writer observed that multimedia in the first cycle increased student learning outcomes by 17.67 percent. In the second cycle, 66.25 percent, and in the third cycle, 87.5 percent.

Using computer-based media is one way to overcome the problem of low learning outcomes. Students can use PowerPoint-based Microsoft Office programs, which allow books to be transferred to a computer and animated. Students will be asked to participate in computer-based media actively. In addition, students can improve their understanding of the subject matter and learning outcomes because they can see and understand these abstract concepts. In other words, easy and exciting computer-based media can increase interest and learning outcomes because it can increase the percentage of learning. This visually appealing program will engage students.

The current problem is finding out about student learning outcomes in the first semester of the Industrial Engineering study program for the 2022/2023 Academic Year at Prima Indonesia University when they are taught using conventional or computer-based learning media. With the aim of knowing the learning outcomes of students who are given computer-based learning media compared to students who are given conventional learning. The results are expected to provide information about how computer-based media improves students' chemistry learning outcomes and helps them understand the subject matter better.

## **2. METHOD**

Media comes from the Latin medium, which means intermediary. In the learning system, the media is an essential component of the lesson plan, which cannot be separated from the lesson plan. Teachers, both teacher and lecturer, must make a media design every time they make a Semester Learning Plan (RPS).

Media is anything that can be used to channel messages from the sender of the message to the recipient of the message so that it can stimulate students' thoughts, feelings, concerns, and interests in the teaching and learning process. Humans, the environment, materials, or events that someone can use to gain knowledge are included in the media category. Some forms of media that can be used in teaching and learning are graphic, photographic, and electronic media, visual and verbal.

Media can also be defined as a message carrier technology for learning, print, audio, and visual communication facilities, as well as hardware. The media also functions as a stimulating tool for student learning, or anything that can stimulate student learning, including their environment and everything that can convey messages. Media overcomes the limitations of the student experience, overcomes space and place, allows direct interaction between students and their environment, makes observations that are the same and different, embeds basic concepts correctly, makes abstract concepts concrete and accurate, and increases student motivation. Media has many benefits, such as making learning messages more standardized and exciting, making learning more interactive, saving time and space, overcoming the power of the human senses, enabling students to study independently according to their visual, auditory, and kinesthetic abilities, and make learning possible anytime and anywhere. Additional benefits of the media are that it overcomes space and time, overcomes the power of the human senses, allows students to learn independently according to their visual, auditory, and kinesthetic abilities, provides the same stimulation, experience, and perception, and increases a positive attitude towards learning and the role of the lecturer.

Each media type has advantages and disadvantages, including small and large media, print and non-print media, audio, visual, audiovisual, video, frame film, and film. Computer multimedia is media that can be studied with several computer programs. Computer applications such as PowerPoint, Macroflash, and Ulied are widely used in learning due to advances in science and technology. Two types of computer multimedia training, computer-based training (CBT) and web-based training (WBT) are computer-based programs that use disk-based CD ROMs as media. CD ROM allows the creation of video clips, animations, graphics, and other multimedia applications. WBT is similar to e-learning, which involves using a computer for learning and the ability to access learning via the internet so that anyone can always be connected to a network. (WBT).

The research was conducted at Prima Indonesia University, Jalan Sampul Medan, in semester one of the 2022/2023 Academic Year. This research was applied to morning class A and morning class B. Morning class A was a control class with 30 students, and Morning B class was an experimental class with 30 students. The sampling technique used is a purposive sample, which means that the sample is taken based on the research objective. The material that is the subject of research is electrolyte and non-electrolyte solutions.

Computer media-based teaching is the independent variable of this study, while the dependent variable is learning outcomes. The use of computer-based media is a measure of media operations. Student learning outcomes are measured by calculating the high and low differences in student scores (gain) after the pretest and posttest are carried out.

Instrument trials were carried out before use. Test instruments to evaluate the validity and reliability (using product moment correlation and KR-20) this is done to consider each aspect of the question (items) in determining the level of difficulty and distinguishing power.

The results of data collection and processing showed that the questions were valid, with  $N = 32$ ,  $\alpha = 0.05$  (count = 0.851 >  $t_{table} = 0.549$ ). There are 32 good questions out of a total of 45 questions tested. Media learning is carried out in the computer laboratory or IT room at Prima Indonesia University specifically for Morning Class B (experimental class only). Morning class A (control class) is conventional chemistry learning or carried out in class only. The research design can be seen in Table 1.

**Table 1. Class Division**

Sampel	Pretest	Perlakuan (x)	Posttest
Kelas Eksperimen	T1	X1	T2
Kelas Kontrol	T1	X2	T2

Information :

T1=Initial test (pretest)

T2=Final test (posttest)

X1=Treatment for experimental class

X2=Treatment for control class

How to provide experimental class learning using PowerPoint, electrolyte, and non-electrolyte material designed in PowerPoint. The hyperlink program is used to build media slides in PowerPoint so that other media views appear when students click on a variable in PowerPoint. By using PowerPoint, feedback questions are given. Learning with a system like this is designed to provide feedback with applause (computer applause) if the answer is correct, and if the answer is wrong, it will be guided back to reading the lesson text listed on a certain PowerPoint number.

Powerpoint is used to display material in the experimental class, and some pictures are taken from the internet. Meanwhile, the control class that did conventional learning used student worksheets (LKM). Student worksheets (LKM) are used with concept maps and questions for students to work on. Students then report how they did their work and what they observed. The material input into PowerPoint for the experimental class and LKM has the same topic. The media consists of questions that contain concept maps and ask for short answers from students.

### 3. RESULTS AND DISCUSSION

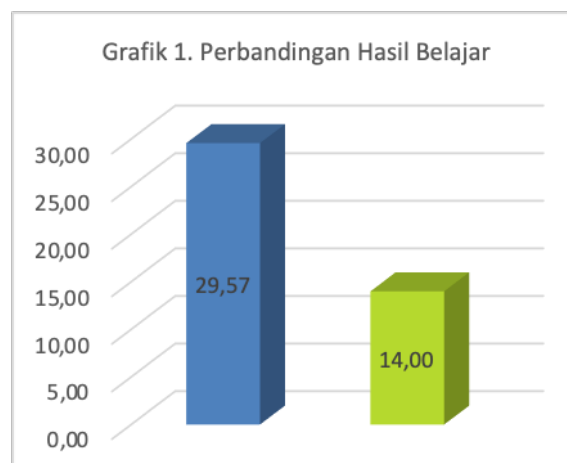
Before the data is processed, tests for normality and homogeneity are carried out to ensure that the data meets the analysis requirements. Tests that have **been** standardized as a research tool. The samples at the beginning of learning are expected to have the same characteristics and the same initial test results after treatment. Students' initial ability as a control for learning treatment can be assessed by the homogeneity test shown in Table 2 and Table 3.

**Table 2. Experimental class data**

	Pretest	Posttest	Difference in Value (Gain)
Min Value	14,44	30,15	17,67
Maximum Value	55.35	80.00	36,76
Average value	34.43	64.00	19.58
Standard Deviation	9.78	9,72	8,74
Variance Square	77.45	98.51	59.94

**Table 3. Control class data**

	Pretest	Posttest	Difference in Value (Gain)
Min Value	6,68	25.00	14,33
Maximum Value	53,34	66,76	15,34
Average value	28.50	42.50	16.50
Standard Deviation	9.47	10.05	7.08
Variance Square	89.30	100.65	49.25





Experimental learning outcomes were better than the control class, as shown in the bar chart in graph 1. Furthermore, hypothesis submission for the two types was carried out to find out the differences in learning applied to the experimental class and the control class as follows:

$H_0$  = Learning outcomes in the practical class are not higher than in the control class

$H_a$  = Learning outcomes in the practical class are higher than the control class

Requirements for acceptance of the hypothesis are Reject  $H_0$ , if  $t_{count} > t_{table}$  at the significance level chosen  $\alpha = 0.05$  of the total sample of 60 students, then  $dk = 58$ . Based on the calculation results obtained,  $count = 4.09$  and  $table = 2.067$ , if entered into the conditions for accepting the hypothesis, Reject  $H_0$  if  $count = 4.09 > table = 2.067$ . The results obtained by count are greater, then  $H_0$  is rejected and  $H_a$  is accepted, so the learning outcomes obtained in the experimental class are higher than the control class, where the experimental class gets a better learning achievement score than the control class.

Semester Learning Design (RPS), learning achievement test kits, and multimedia with evaluation (evaluation questions) are products for the experimental group. Products created through the Media PowerPoint program can be presented in various forms. This includes PowerPoint slides and hyperlinks, questions with hyperlinks, and the ability to display specific menus in PowerPoint.

Using computer-based multimedia can increase student interest, motivation, and curiosity. This is because the ideas are presented in an eye-catching, repeatable form, with questions and colorful animations. Competition occurred between the experimental and control groups during the different treatments. This competition can improve learning outcomes. After the research was completed, computer media-based learning was applied to the control class. This was done to prevent the control class from falling behind the experimental type.

This research product can be used to teach Electrolyte and Electrolyte Solutions using the Powerpoint media program and feedback questions. The research product in the control class is a concept map media with a Student Worksheet (LKM) on chemical material, namely electrolyte and non-electrolyte solutions, and students must fill in the LKM.

#### 4. CONCLUSION

Submission of a hypothesis stating that students get better chemistry learning outcomes when they are taught with computer-based learning media compared to teaching without computer-based media, namely conventional media for electrolyte and non-electrolyte topics, was successfully proven based on the results of data collection, data processing, and hypothesis testing.

#### 5. CLOSING

This research proves that educational media-based learning can improve learning outcomes, so the government educational places, such as schools and campuses, are advised to apply computer-based media. However, this writing is only free of deficiencies in further research. Research is needed to investigate the same or different subjects about computer-based learning with various computer media.

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