



EVALUATION AND VALIDATION OF CHEMICAL INDUSTRY PROGRAM USING COMPUTER ASSISTED INSTRUCTION

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ABSTRACT

This research aims to improve the competence of students of the Department of Industrial Engineering in Indonesia in the subject of Chemical Industry, in particular through the model-based teaching materials Computer Assisted Instruction in the form of an interactive CD. In particular, the study carried out for the purpose of: (1) Designing and developing models of devices based learning CAI (Computer Assisted Instruction) systematically in prototype form, (2) Produce an interactive CD as a model learning devices Chemical Industry based CAI (Computer Assisted Instruction) to improve the competence of students Department of Industrial Engineering in Industrial Chemistry courses. A product produced in this research is the design of teaching materials based CAI (Computer Assisted Instruction) in the form of an interactive CD that includes the implementation of the design and programming of interactive CD. In this research produced interactive CD and Post Production activities which include activities conducted justification expert evaluation, conducted trials on stakeholders, be revised based on input from experts, and do packing and labeling. It also carried out activities Design and Programming interactive CD, so that the resulting interactive CD is ready for use.

Keywords: evaluation, competency, industry, CAI, chemical.

INTRODUCTION

Computer is one medium that can help students in drill and practice activities. With the support of software (software) in the form of programs, then students can train themselves to use it properly, develop, and produce works in accordance with the capabilities, expertise, and needs. One program that can help a student is CAI. CAI Computer Assisted Instruction is made by creative people who create a medium of learning with learning strategies that are based on student needs. Where students can obtain information / messages in a fun and personalized, because CAI provides a method of learning in the form of tutorials, drill and practice, simulations, problem solving, data base up to the games.

CAI (Computer Assisted Instruction) or CAL (Computer Assisted Learning) is defined as computer assisted learning (PBK). CAI but the term is more familiar, so henceforth use the term CAI. There are many definitions kick CAI or Computer Assisted Instruction. Among them is the general definition expressed by Hannafin, namely that "CAI regard to any learning situation in which the activities and learning materials delivered via computer [1]. CAI also combine and synergize all media consisting of text, graphics, images, video, animation, music, narration and interactivity that are programmed based on the theory of learning. An opinion about CAI, which is an interactive application program that can be used as a medium, conveys information as well as evaluation of learning media. Furthermore CAI can be used as a tool in independent learning for students. Use of CAI in learning is one of the alternative methods that attract and able to provide a real picture of the material that is abstract [2].

The term generally refers to all the CAI education software that is accessed through a computer where the user can interact with it. The computer system can present

a series of learning programs to students, either in the form of information concept and practice questions to achieve certain goals, and student learning activities by interacting with the computer system. While in his position can be said that CAI is the use of computers as an integral part of the instructional system, where the user usually tied to the two-way interaction with the computer. CAI interpreted as forms of learning that puts computers in the role of educator [3,4,5]. Meanwhile, CAI is a learning program that is created in the computer system, which convey a pre-defined material directly to the user [6,7,8]. The subject matter is already programmed can be served simultaneously between the components of the image, text, color and sound.

Activities to do with CAI includes 4 main categories, namely: 1) Drill and Practice, 2) Tutorial, 3) Games, and 4) Simulation. In training activities, the computer gives questions about a topic fatherly solved by the students and the computer gives feedback based on the student's response. Activity tutorial intended to teach new information on a topic. The game can serve as a presenter or a new lesson material as well as the reinforcement of the lessons learned through the activities of other students. In the simulation or modeling, computer simulations or models provide a concept or event to be input by the student and the computer will give a response to these inputs as the actual system will act. So CAI is learning everything that is programmed using a computer and allows the user to interact with and usually for the purpose of independent learning.

One factor determining the quality of graduates majoring in industrial engineering is the quality of the implementation of learning. Besides, the main obstacle has been the lack of teaching materials based CAI (Computer Assisted Instruction). In fact, the competence of students of the Department of Industrial Engineering in



Industrial Chemistry course is still very low. Therefore we need an innovative teaching materials based CAI (Computer Assisted Instruction) in the form of an interactive CD that does not exist in the Department of Industrial Engineering in Indonesia to improve the competence of students in the subject of Chemical Industry. Thus, by using this interactive CD, students Department of Industrial Engineering in Indonesia can increase their competence in the Industrial Chemistry Lecture.

RESEARCH METHOD

This study uses the procedures of research and development (Research and Development) is thus through the procedures and field trials. The method of research and development in principle is a process for the development of a product of education and next validated [8, 9, 10]. The products that will be developed and validated teaching materials Chemical Industries is based CAI (Computer Assisted Instruction). In this study testing the effectiveness, efficiency and attractiveness of teaching materials based Industrial Chemistry CAI (Computer Assisted Instruction), researchers used an assessor or observation and feedback of students, peers, and student learning outcomes. The effectiveness of the tested models of student learning outcomes by using pre-test and post-test, while the appeal is usually measured by the scale of attitudes, self-evaluation and student opinion regarding the teaching material based Industrial Chemistry CAI (Computer Assisted Instruction) in accordance with the conditions and needs.

The sampling technique used is sampling considerations (purposive sampling) which have the characteristics in classes where many students have to follow a remedial program for the course Chemical Industry. To collect data on the initial information about the student learning process Chemical Industries today as a needs analysis study represented 10 students to a preliminary study. Similarly, the early stages of field tests, the study only do one class which classes are being / well with the base average GPA is determined 3. Based on these considerations such as class field testing of teaching materials based Industrial Chemistry CAI (Computer Assisted Instruction). Planning research steps at the stage of the seventh due to the lack of researchers and according to the needs of the research itself as well as by statements Borg and Gall, development of teaching materials is a form of research and development of small-scale limited [11,12,13,14]. This means allowed if it gets on the seventh stage, but does not detract from the purpose to be achieved that is obtained in the form of educational products based teaching materials Chemical Industries CAI (Computer Assisted Instruction) [15].

For data-collection efforts necessary research then developed the instrument in accordance with the needs of the data and information collected. The study consists of a grating and instrument in the form of questionnaires and tests. The data analysis technique consists of quantitative and qualitative. Quantitatively analyzed using quantitative descriptive statistics inferential

analysis, while quantitative analysis with a way to describe in a narrative. Qualitative data analysis procedure performed through three stages, namely the process of data reduction, data presentation, and decision making.

The resulting product is design-based teaching materials CAI (Computer Assisted Instruction) in prototype form, with the following steps:

a. post-production

Evaluation: do justification expert

Friendly: the tests on stakeholder

Revision: revised based on input from experts

Finalization: do packing and labeling.

b. Design and program in accordance with the test results

c. The results of this study in the form of an interactive CD for learning the chemical

Stages of the research conducted are shown in Figure-1 are as follows:

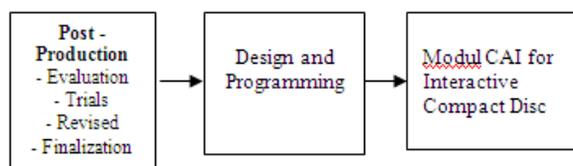


Figure-1. Flow chart for this research.

RESULTS AND DISCUSSIONS

Product description

Before the product is produced teaching materials produced in the research development of this form of Compact Disk (CD) Study of Chemical Industry of interactive, first performed the development of concepts related to the Chemical Industry. Then do the development of the Compact Disk (CD) Chemical Industries interactive learning means that these materials are two-way interaction. Users can choose to learn the material on the CD as desired. This instructional material created using Adobe Flash CS6 program adobe products. Making interactive CD instructional materials is done with three stages in accordance with the draft design plan, namely pre-production, production, post-production. Pre-production stage is the initial stage in the form of a needs analysis, development of teaching materials, the content development of interactive CD, the collection of support materials, and the development of design in the form of story board. The results of a needs analysis based on empirical studies of the students and teachers that need their innovative teaching materials from the chemical industry. Because the chemistry industry is a lesson that is still considered difficult and teaching materials available still conventional so less attractive to be studied. Material development conducted by researchers with justified by two experts in the field of chemical industry. The material developed in this teaching material such as 7 chapters,



namely: Chapter I of a chemical messenger industry, chapter 2 of stoichiometric, chapter 3 of the solution, the 4th chapter of the chemical balance, chapter 5 of aliphatic hydrocarbons, chapter 6 cyclic compounds and aromatic, and chapter 7 of the chemical industry.

The collection of material support in making this interactive CD is sound, graphics, music, animation which is the source at the design stage. Graphing through the process of cut and paste and editing using Adobe Photoshop CS6 program adobe production. Making good sound or music recording and editing using the program adobe audition adobe production. Making animation using Adobe Flash program from Adobe CS6 production. Designing the contents of interactive or multimedia CD was developed to create a story of board. Storyboarded the entire lay out of the contents of this interactive with CD. Production stage is the process of making of interactive cd. This stage is the post production of the overall interactive cd's. All material is good material, graphics, animation and sound or music designed by researchers correspond story of board planned. The program used in the production stage are adobe flash CS6 production of adobe.

Post-production stage is the stage of validation in making this interactive cd. The validation phase is intended to look at the weaknesses and shortcomings of this interactive cd. The results of this phase in the form of recommendations for the revision of the product. Phase validation is performed to the user with technical experts and one to one and small group. Interactive CD that has become temporarily given to students and experts either an individual or a limited group to try this interactive cd. Next they were asked or fill out a questionnaire to provide feedback according to what they feel. The result of the material used as input to revise the interactive cd. Cd which has undergone further improvements on finalization and labeling and packaging as a prototype. Prototype interactive cd further as materials for post hock production and dissemination in the form of a field test which is the advanced research.

Products characteristics

Teaching materials in the form of interactive compact disc containing the software program or on the chemical industry. This cd is a combination of media text, audio and visual, interactive or multimedia called. The con-tents of this interactive CD consists of four parts: the intro, the main menu, materials, training and evaluation. Intro menu contains appetizers frame when the first time the program is opened. Furthermore, this intro into the first gate to enter the main menu. In this intro available navigation keys "enter" whose functions go to the main menu, can see Figure-2:



Figure-2. Frame of introduction [16].

Frame main menu contains interface frame that can go the whole material content of this interactive CD. On the main menu navigation buttons are separately enter the whole chapter CD material is composed of seven chapters, can see Figure-3.

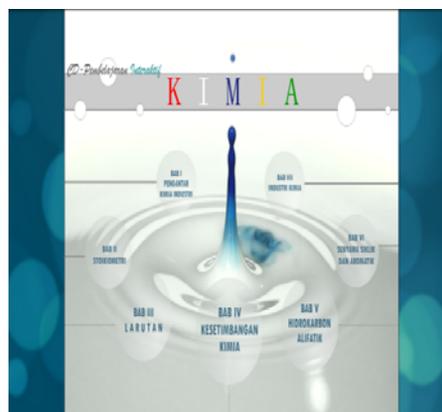


Figure-3. Frame of main menu [16].

Furthermore, each of the navigation key to enter the frame material of each chapter. In every frame material contained navigation buttons "next" and "prev". Navigation key "next" function is continued in the form of the material in the chapter or sub-chapter discussion of subjects such material. Navigation key "prev" to go back to the previous section, and so on. In the chapter and sub-chapter menus are navigation buttons material, training, evaluation, exit, intro. Navigation functions material to the main menu that contains a menu interface to all content of the material. exercise its functions for the navigation key to enter the exercise menu containing practice questions in the beb. Navigasi button to enter the frame evaluation function evaluation is the final part of the learning interactive in CD, can see Figure-4.



Figure-4. Frame of section menu [16].

The menu contains practice exercises to determine the extent to which users understand the content of the material each chapter of this interactive CD. Exercises include answer key as answer key. If the answer button on tap will be out the answer key, can see Figure-5.



Figure-5. Frame of exercise menu [16].

Menu evaluation to evaluate the extent to which the user's understanding of the material throughout the chapters in the cd. The questions in the evaluation of multiple-choice questions and so provided an alternative answer. The users simply press the answer option, can see Figure-6.



Figure-6. Frame of evaluation menu [16].

In the evaluation menu also provided the answer function checks to see answers are correct or not. Having completed work on all evaluation questions then the end will show the value and number of answers about who is right or wrong. Furthermore, can hit the back button to repeat the evaluation, can see Figure-7.



Figure-7. Frame of final score [16].

Advantages program

Some of the advantages of the program of teaching materials based CAI of Chemical Industry are as follows:

- Capacity program file-based teaching materials Chemical Industries of CAI approximately 30 MB small enough so as not to burden the load computer system.
- Industrial Chemistry program instructional materials based CAI is interactive as the user desires.
- The navigation buttons at the Industrial Chemistry program instructional materials based CAI is quite simple so familiar to end users (end-user).

Programs can be conducted themselves independently. Learning program can be customized by the end user learning speed.

Procedures utilization products

The program has been equipped with the system start up autorun CD program will automatically run once inserted into the CD-ROM drive. Applications used files have .exe format that does not require other supporting software to display the contents of the CD program. After running the program it will perform for the first time intro and title of the program. Then the program will go automatically to the main menu contains menus on the CD of this program is the material and evaluation.

Effectiveness model

The above initial prototype tested to some media experts, the result of which is as follows:

A) Results of trial expert media

Trial by media experts, given to two media expert lecturers from the Jakarta State University who are



involved in the learning media. The response from the media experts are as follows:

a. Aspect display

- a) Selection of background has been good
- b) Graphic (images, photos and graphics) are already well
- c) Compliance selection of the type and font size, spacing, line, paragraph, and character is good and appropriate
- d) The color selection is not monotonous
- e) setting the layout is good
- f) The consistency of presentation is good
- g) Compliance screen design of each page is consistent

b. Aspects program

- a) Clarity of the instructions for use are good, as are the navigation as easy to learn and difficult
- b) keys are provided is in accordance with its function and its use
- c) From the side of the screen has a maximum efficiency
- d) The narration and text provided already well
- e) The response to the possibility of user response has been interesting

c. Aspects of learning

- A. Selection of the material is already well
- B. There is already a clear formulation of the material, the consistency of the contents of the CD, the clarity of the description, and the clarity of the sample questions
- C. Provision of tests and feedback already meet
- D. Quality of learning interaction is still lacking
- E. There is ease in accessing, consistency tests with the purpose of learning is good, as well as the feedback
- F. Availability of other learning support is good enough

B) Individual trial results

Individual testing is given to a student and a professor of chemical industry.

a. Response from students

- a) The initial character display is good enough
- b) The screen and keys are appropriate
- c) Sample exercise is good
- d) There is already a problem-solving
- e) Overall it has been nice

b. Response from lecturers

- a) Writing letters is appropriate
- b) There are already examples of problems and settlement
- c) Background is in conformity
- d) The number of exercises is appropriate

C) Results from pilot small group

Small group trial was given to 10 students to obtain input to update this interactive CD product. Small group trial results are as follows:

- a. display background was appropriate
- b. The coloring on the menu was appropriate material
- c. Great views are in accordance with the monitor screen
- d. feedback given was appropriate if the user can complete the exercises

D) Field trial results

Interactive CD product tested to elbih large group again. The purpose of this trial is to look at the effectiveness and benefits of this interactive CD for the chemical industry. Data consisted responses faculty and students as well as the results of tests that exist in the interactive CD.

A. Results response lecturer

- a) Generally own interest and can be used appropriately
- b) The material is in conformity with the needs of students
- c) Staining in the display is appropriate

B. Student feedback results

- a) Overall it has been nice
- b) the background was appropriate



- c) Can be used for all of the students who study the chemical industry
- d) If you can, other material besides the chemical industry can be made interactive CD.

strive to know the contents and matters related to learning CD chemical industry.

CD interactive learning model development of chemical industry

The development model of learning by using interactive CD's chemical industry is very necessary when other learning media can help significantly less. Teachers can make efforts evoke the spirit of learning more in the classroom by using model with this interactive CD. Within this learning requires facilities to support them is the use of laptops or computers used by students. Therefore, if it cannot be used in the classroom, the computer lab can be an alternative place of learning with this interactive CD.

In this study proves that most students feel the difference in achieving competence the material being studied. Students are more enthusiastic in learning and

The effectiveness of CD interactive learning model chemical industry

In order to determine the effectiveness of CD interactive learning model industrial chemistry shown from the results of the acquisition value of the use of students learning to use this model. Of the 25 students there, all of them get a value above C or more than 70. This situation means that in terms of the delivery of content more easily accepted by the students and the students can directly perform the evaluation form provided in the interactive CD's chemical industry. In addition, students get immediate feedback without having to wait so long so students can immediately correct his mistake. Of the 25 students enrolled in this study are given a questionnaire on the effectiveness of the development model of interactive CD chemical industry. From the data obtained the following results, can see on Table-1:

Table-1. Results of the effectiveness of the development model of interactive CD chemical industry.

No.	Indicators	Percentage (%)				
		Very Good	Good	Enough	Less	Very Less
1	Instructions Usefulness	17	68	5	10	0
2	Display Quality	17	53	30	0	0
3	Color composition	23	48	15	14	0
4	Carrying capacity of the audio	40	36	14	5	5
5	The size and typeface	13	46	38	3	0
6	Ease of navigation	16	45	33	6	0
7	Length of time	17	45	38	0	0
8	The quality of the CD program	26	46	23	5	0
9	Beauty product packaging	7	50	33	10	0
10	achievement of competence	32	54	14	0	0
11	Variations of information delivery	30	50	16	4	0
12	Ease understand the material	16	37	42	5	0
13	Problems example	15	64	11	5	5
14	Quality problems	41	47	9	3	0
15	Feedback from problems	12	53	30	5	0

Shown from the table that the overall learning with this interactive CD models are an effective way and place to deliver material to the level of mathematical competence of students expected to be reached.

- a) Based on the instructions for use, 14% said very good, 71% said good, 5% said enough, and 10% said less. This means that the instructions for use is still considered good and easy to follow.

- b) The display quality, 19% said very good, 48% said good, and 33% stated enough. This means that the display quality is good.
- c) From the color composition, 29% said very good, 43% said good, 14% said enough, and 14% said less. This means the user is still considered a good color composition.
- d) Carrying capacity of audio, 33% said very good, 43% said good, 14% said enough, and 5% said less. This



- means that the carrying capacity of audio categorized as good.
- e) The size and typeface, 10% said very good, 43% said good, 42% said fairly, 5% said less, and 5% said very less. It means the size and typeface is still good and legible.
 - f) Ease of navigation, 14% said very good, 43% said good, 33% said enough, and 10% said less. This means that the perceived ease of navigation is quite easy to follow.
 - g) Length of time, 14% said very good, 48% said good, and 38% stated enough. This means the time in CD enough and no more.
 - h) The quality of the CD program, 24% said very good, 48% said good, 23% said enough, and 5% said less. This situation means that the quality of the CD program, including unpopular.
 - i) Beauty product packaging, 5% said very good, 52% said good, 33% said enough, and 10% said less. This means existing packaging favored by respondents.
 - j) Then, when seen from the pre-test and post-test, then seen a significant difference between before administration of learning by using interactive CD with after using interactive CD. The average value when pre-test before using the learning that is interactive CD is 48.00, while after using interactive CD and given a post-test average value was 70.20. This means there is a difference of 22.20 results caused by changes in the treatment of learning to students.

CONCLUSIONS

Based on trial results interactive CD program chemical industry to the various components, it can be stated that interactive CD chemical industry is considered feasible to use. The effectiveness of the use of this interactive CD in learning from the results indicated that increased learning, a willingness to try, and the opinion of the subject of the trial stated that the development model of learning using interactive CD is considered effective. Based on this description, the results of research development of interactive CD as teaching materials based industrial chemicals CAI considered effective and fit for use, either for independent study or in a classroom learning course on industrial chemistry.

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