



# Proceeding

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& Call For Paper 2012*

## Information and Communication Technology ( ICT ) in Education

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**“Z80 SIMULATOR” FOR IMPROVING STUDENT COMPETENCE  
IN MICROPROCESSOR FIELD OF SUBJECT**

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**Abstract**

This paper presents the use of “Z80 Simulator” for enhancing the student competence in the practice course of microprocessor subject at Electrical Engineering Department, Yogyakarta State University. According to the Classroom Action Research method, there are four stages that should be taken, firstly is planning for action, second step is implementation of the action by using Z80 Simulator in the classroom, the following step is observation of the learning process and the final stage is reflection based on the observation data. Performance measured in this paper is the suitability of Learning Process with a plan of action and the percentage of students who get B score and above. The result shows that a) the Learning Process in the microprocessor field of subject by using Z80 Simulator not optimal yet in certain terms, b) the Learning Process by using the Z80 microprocessor simulator can obtain the number of students who got a B score reaches 75%.

Keywords: Z80 Simulator, Microprocessor Field of Subject

**A. INTRODUCTION**

Microprocessor field of subject is practical course that have 2 credits and usually take a place at Control Laboratory of Electrical Engineering Department,

Yogyakarta State University. In this course, students are taught about how to recognize, understand and program a Z-80 microprocessor.

In the learning process, students sometime encountered many obstacles, one of the biggest problem is difficulties to translate mnemonic language to become operation code (op-code). Mnemonic is the language that easily understood by user, but the Z80 microprocessor did not understand it well. While the op-code is a language that can be received by the microprocessor, but it is very difficult to be understood and memorized by the user (human). In the process of programming microprocessor, firstly, the student must create a sequence of instructions in mnemonic. After that, the mnemonic is converted to the op-code by using op-code table. Op-code table consists of hundreds code, giving difficulties to find an appropriate code and taking a long time.

Translation process from mnemonic to op-code is sometime getting errors. Errors occur due to inaccurate when reading the code. In addition, thesequence of many code, will take a long time. During the course, sometime the power failure happened and the op-code that already entered to Z80 microprocessor will be lost. The students should be entered op-code again and this will cause wasting time.

Learning achievement of this course is low, based on the data that taken from the year 2005/2006. According to the data at year 2005/2006, it can be clearly seen that achievement of the B score got 60% only. This fact indicates that the main problems caused by the use of Z80 microprocessor are less efficient on the learning process.

One of the best ways to reduce the time-limit problem is utilizing "Z80 Simulator" which is a kind of computer program that can run properly like Z80 microprocessor. By using "Z80 Simulator", the op-code can be stored as well as storing files on the computer, and can be called again. In addition, it is not necessary to convert mnemonic to op-code in which this process takes a long time. By using "Z80 Simulator", students can test many programs and the practice will be more efficient. Students can conduct many experiments easily and can increase student competence in the microprocessor field of subject.

## **B. MATERIALS AND METHODS**

### **1. Teaching and Learning Interactions**

Teaching and learning interactions is an interactive activity of the various components to realize the achievement of learning objectives as set out in lesson planning. To reach that objective, we need to be understood about the meaning of the learning, teaching and interaction terms. The third meaning of those terms will lead us to the understanding the meaning of teaching and learning interactions (Depdiknas, 2003).

Learning in general can be interpreted as behavior changes due to individual interactions with the environment. The process of behavior change does not happen by itself, but there is a deliberately planned and by itself due to maturity process. The process, that is deliberately planned to change this behavior, is called the learning process. This process is a psychological/mental activity that takes place in an active interaction with the environment which results in relatively constant and traceable changes. These behavior changes are the result of learning process that includes cognitive, affective and psychomotor domains (Bloom, et al).

### **2. Learning Media**

The term of media comes from the Latin language, which is the plural form of "medium", that have literally means the intermediary or the introduction. General meaning of media is anything that can be used to relay information from the sources of information to the recipient information. This medium term is very popular in the communication field. Teaching and learning process is essentially also a process of communication, so that the media used in the learning process is called learning medium. (Aristo: 2003)

Learning is a complex process that happens to every person throughout their life. This learning process is due to the interaction between a person with their environment. Therefore, learning can occur anytime and anywhere. According to Azhar Arsyad (1997) characteristic of a person has to learn is a change in behavior that may be caused by a change in the level of knowledge, skills or attitudes are influenced by their environment. The environment are students, teachers, librarians, course materials (*books, modules, leaflets, magazines, video*

tapes, or audio and the like), a variety of learning resources and facilities such as overhead projector, audio and video tape recording, radio, television, computer, library, laboratories, learning resource center and others.

### **3. Z80 Simulator**

In the microprocessors practice course, it takes a device or module that can be used as a tool to conduct experiments in microprocessor programming material. All this time, students in Department of Electrical Engineering Education FT UNY still use a hardware microprocessor module i.e. Zilog-80 microprocessor module. This hardware module still has many weaknesses that make the learning process in the microprocessors practice course become less optimal.

There is one alternative module of Z80 microprocessor, which is Z80 module in software form or commonly called the Z80 Simulator. Z80 Simulator is one of the Z80 software applications that can be used to conduct materials of Z80 microprocessor programming experiments like used a hardware module. Z80 Simulator is running on the Windows operating system featured by a display that is easy to use, this feature commonly called IDE (Integrated Development Environment).

Z80 Simulator IDE is a powerful application that supplies Z80 educators and developers with a user-friendly graphical development environment for Windows with integrated simulator (emulator), Basic compiler, assembler, disassembler and debugger for Zilog Z80 8-bit microprocessor.

Z80 Simulator IDE has extensive program options and consists of a memory editor for 64k memory. It also features a conversion tool for IEEE 754 single precision floating point numbers format.

The basic compiler is bundled with a smart basic source editor. The purpose of code debugging can be solved using the breakpoints manager that has a support for breakpoints. It also consists of an I/O ports editor which can simulate I/O instructions. External simulation modules can be used with this application.

This application would enable the users to use a set of simulator tools bundled up in a single application. It has various color themes that can be changed by the user. The log viewer helps to view simulation logging, variable simulation



rate and simulation statistics generated by the application. The assembler editor is graphic intensive that makes it easy for beginners to operate. Users can use this program to build some fast real-time functions. The program helps in easy detection of bugs from beginning.

Several advantages of Z80 Simulator compared with the Z80 hardware module is as follows:

- Z80 Simulator is a software application so it making easy to carry and removable.
- A user-friendly display.
- The ability to store a mnemonic and an op-code.
- The ability to call the code that has been stored previously.
- Facilities for debugger, assembler, and disassembler.
- Displays the contents of Z80 register directly.
- Displays the next and previous instruction.
- A logging facility.

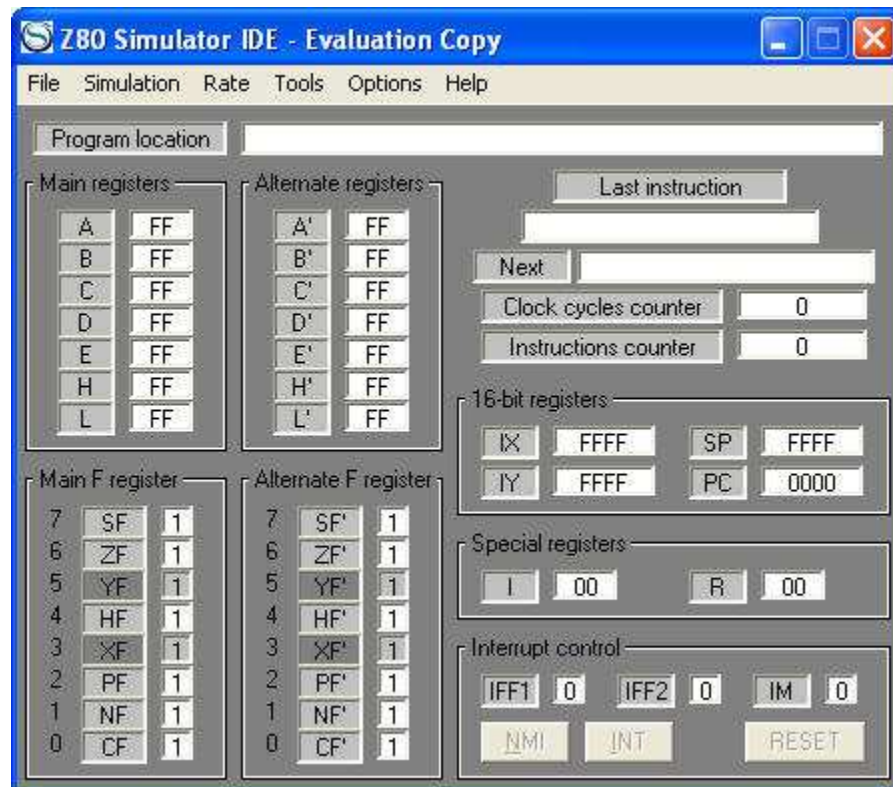


Figure 1. Main Window of Z80 Simulator IDE

#### 4. Classroom Action Research

This paper provides the use of “Z80 Simulator” for improving the student competence in the practice course of microprocessor subject. The method to pursue the goal of this paper is by using Classroom Action Research method.

Classroom Action Research is a method of finding out what works best in the classroom so the teacher can improve student learning. Kurt Lewin, in his paper “Action Research and Minority Problems” (1946), described action research as “a comparative research on the conditions and effects of various forms of social action and research leading to social action” that uses “a spiral of steps, each of which is composed of a circle of planning, action, observation and reflection”. Action research process embarks on a problem finding, and then formulating possible actions for the problem, applying an action, and finally evaluating on the outcome of the action. These activities go round in a circle. Sometimes, the teacher should repeat the process until they can get the desired behavior.

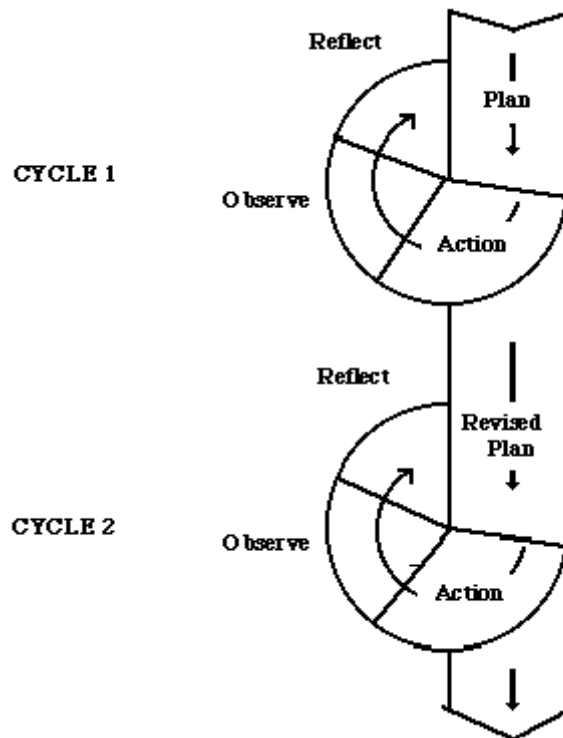


Figure 2. Classroom Action Research by Kurt Lewin

## C. RESULT AND DISCUSSION

### 1. Teaching and Learning Process Conformance with the Plan of Action

According to the observations stage, Teaching and Learning Process conformance with the plan of action in each cycle is shown in Figure 3. The figure shows that the action plan from cycle to cycle has increased. Nevertheless, there are still aspects that have not been able to achieve the maximum score, such as: 1) creating a variety of learning, 2) managing the classroom, 3) showing the asking skill, 4) generating student interest, and 5) encouraging student participation. Those kind of weakness can be made as reference for researchers in order to improve teaching in microprocessor course in accordance with the aspects mentioned above who have not received the maximum score.

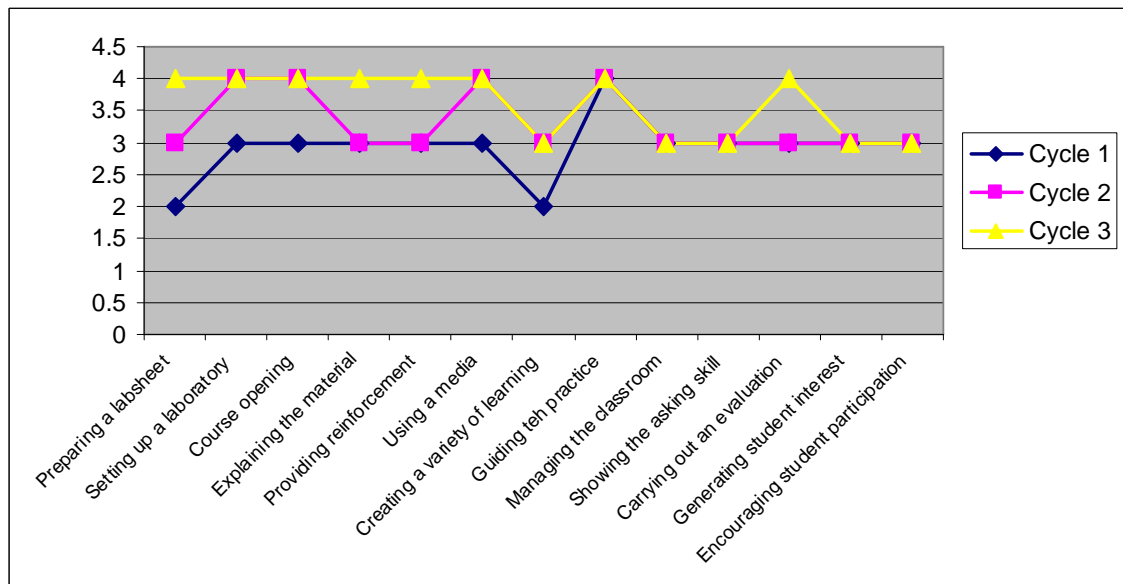


Figure 3. Teaching and Learning Process Conformance with the Plan of Action in three cycles

### 2. The Percentage of Students Who Get B Score and Above

The percentage distribution of the final test in microprocessor field of subject is shown in Figure 4. The figure shows that there are any students who got below B score, which is about 25%. In fact, there was one student whose got D score, it happens because the student does not meet the minimum attendance of 75%. However, students who earn a B score and above is reached 75%.

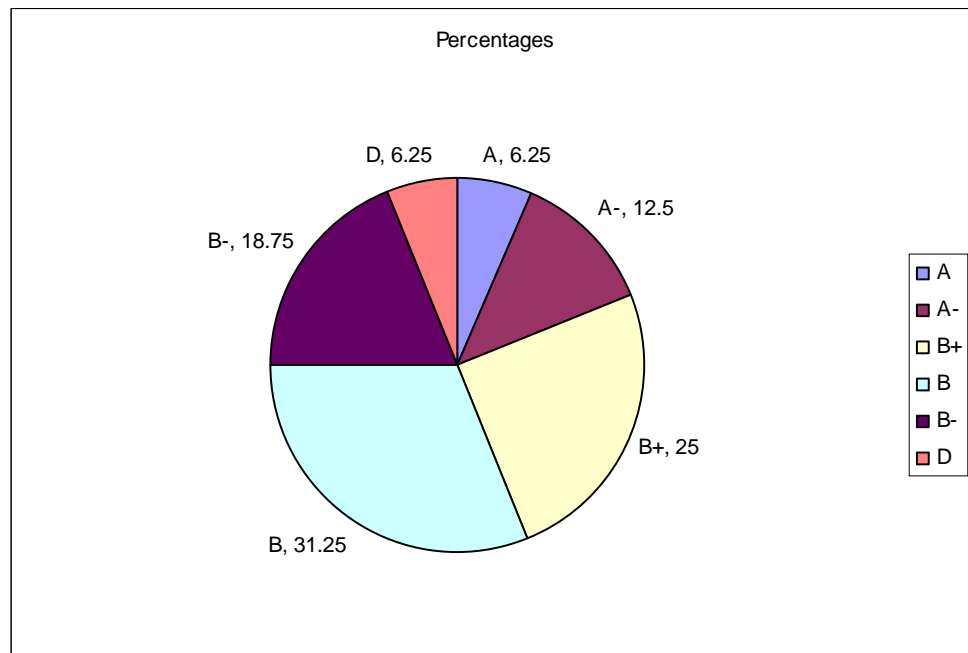


Figure 4. The Percentage of Students Score

#### D. CONCLUSION

Teaching and Learning Process in microprocessor field of subject by using the Z80 Simulator in this paper is still not optimal yet in certain aspects such as 1) creating a variety of learning, 2) managing the classroom, 3) showing the asking skill, 4) generating student interest, and 5) encouraging student participation.

Teaching and Learning Process in microprocessor field of subject by using the Z80 Simulator can enhance the number of students who get B score and above about 75%.

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