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Application Learning of Configuration Electron Chemical Elements

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ABSTRACT

Chemistry is a compulsory subject in high school, especially in the natural sciences department. In chemistry lessons, there are several sub-topics, one of which is the periodic system of electron configurations. Electron configuration relates to several other sub-topics. So that the electron configuration has an important role in the study of chemistry. The location of an element in the periodic table can be determined by determining the electron configuration of the element. So that the application of technology in helping students to understand electron configuration is needed. Intelligent computer assisted instruction is the application of artificial intelligence in the field of education that can be used to create more effective learning and can increase the willingness to learn and increase student motivation to learn. So it is necessary to make an application for learning the electron configuration of chemical elements. The resulting application has several learning support features, namely material, evaluation, discussion, and glossary. This application is built using the Fisher Yates Shuffle algorithm for randomization of numbers which is applied to practice questions. The application can run well on android devices version 4.4 or the latest version. Applications can measure students' mastery of learning materials more accurately. From the test results obtained 86% of respondents gave a positive response to the application that was built. Likewise, 60% of respondents expect further development. Either on the same material or on other chemistry materials to make learning more interesting and fun.

1. Introduction

Chemistry subjects are compulsory subjects for high school students, especially the natural sciences major. Chemistry is one of the subjects that students do not like. Many students feel bored and not interested in studying let alone studying chemistry. Chemistry also has its own language/terms so that students cannot understand chemistry without understanding the vocabulary. In addition, Chemistry is less preferred because it is abstract so that a learning media is needed that can further concretize these abstract concepts (Helmenstine, 2017).

Intelligent Tutoring System (ITS) is a type of artificial intelligence system that handles learning or training problems. The main advantage of using ITS compared to methods that are often used is the creation of a more effective learning (Suyanto, 2002).

The electron configuration of an atom or often also referred to as the electron configuration of chemical elements is a very basic material before in chemistry. There is a regular relationship between the electron configuration and the periodic system (Priambodo, 2009). By understanding the electron configuration of an element, students can determine the location of the element in the periodic system. The periodic system of elements plays a very important role in the discovery of new substances, as well as in the classification and organization of the accumulated chemical knowledge. The periodic system is the most important table in chemistry (Saito, 2008). So we need an application that is able to explain the electron configuration of

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chemical elements. Likewise with applications that are able to explain related theories in determining the electron configurations of chemical elements.

Computer-based learning is a learning method solution to keep pace with the increasingly rapid and very influential technological developments in the world of education. With the development of this technology resulted in the development of science that has a positive or negative impact. The development of this technology starts from developed countries, so Indonesia as a developing country needs to align itself with the developed countries. The development of science and technology increasingly encourages renewal efforts in the use of technological results in the learning process. From several learning models, there is an interesting learning model that can trigger an increase in students' reasoning, namely the computer-based learning model. Basically, computer-based learning is a brain-matched teaching system that generates meaning by linking academic content to technological contexts. (Trianto, 2007).

Electron configuration is the arrangement of electrons in the orbitals of an atom. The writing of the electron configuration follows the rules, (1) the Aufbau principle, namely the filling of electrons according to the order of energy levels from the lowest first to the highest; (2) the Pauli exclusion principle, namely in the same orbital there can be no two electrons that have the same value of four quantum numbers. For example, an electron is at 3p4: n = 3, l = 1, m = -1 and s = -1/2; (3) Hund's rule, namely filling electrons in orbitals with the same energy level (orbitals in one subshell) must not be paired first before each orbital is filled by an electron with the same direction/spin. The rules/sequences for filling electrons based on sub-shells are as shown in Figure 1.

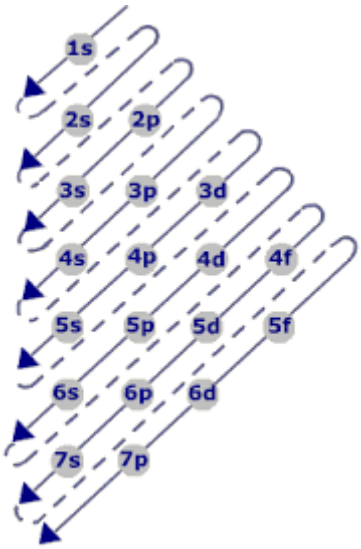

Fig 1. Electron Charging Sequence

Fisher Yates shuffle algorithm is used to change the order of inputs given randomly. The permutations generated by this algorithm appear with the same probability. This algorithm is declared possible because the permutations generated by this algorithm appear with the same probability, this is evidenced by the experiment of randomizing a set of cards that is repeated. Fisher's Yates method in general is (1) when there are still elements left to shuffle; (2) pick an element at random from the remaining elements; and (3) then swap with the current element.

2. Methods

The way this application works is that the introductory material will be presented first, followed by an explanation of the electron configuration. Furthermore, the user can ask questions about the electron configuration and other matters related to it by entering the atomic number and atomic charge. An overview of the working process of the electron configuration application as shown in Figure 2.

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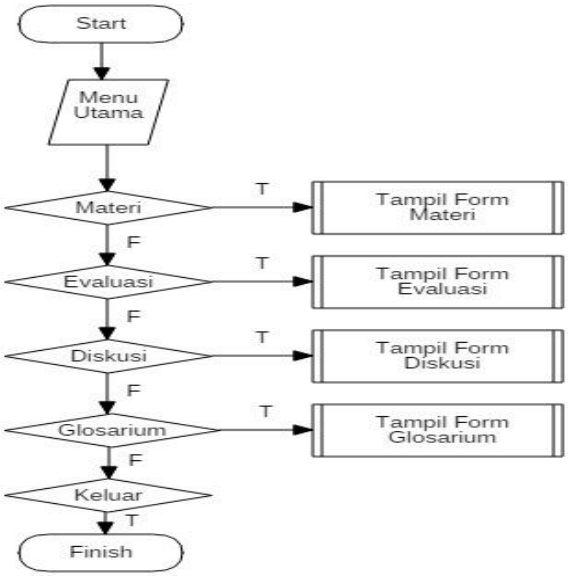
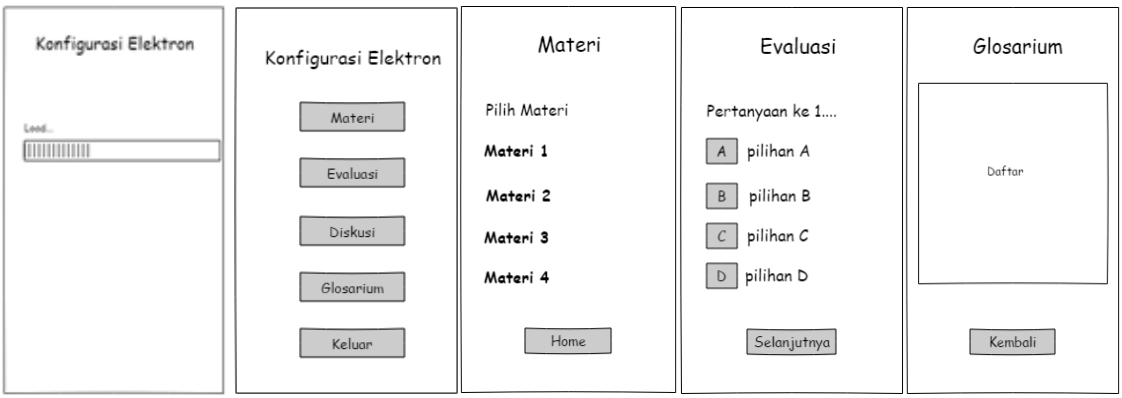


Fig 2. Main Menu Flowchart

The application design stage uses Adobe Flash CS 6 with the Actionscript 3.0 programming language. In this design, it is necessary to design an interface for electron configuration as shown in Figure 3a. Then design the main menu form as shown in Figure 3b. This form contains the Material, Evaluation, Discussion, and Glossary menus. Material menu, serves to display material regarding electron configuration. Evaluation menu, serves to display questions regarding electron configuration to test user understanding. Glossary menu, serves to display a list of terms in the field of chemistry in this case regarding the topic of electron configuration. The Discussion menu serves to conduct discussions with the application. Furthermore, the design of the material form is as shown in Figure 3c. This form will appear when the user selects the material menu. In this design the material will be divided into 4 sub materials to make the material not too long because it can make the user bored even before reading the existing material. The evaluation form design is like Figure 3d which displays questions or questions about the material on the material menu to test the user's understanding of electron configuration. When the user presses the 'Evaluation' button on the main menu, the application will first display the instructions for working on the questions. If the user presses the 'Next' button on the question processing instructions frame, the application will randomize the questions. In this application, 30 practice questions have been included in 30 frames. Randomization of questions using the Fisher Yates Shuffle Algorithm. Because there are ten questions on this menu, the randomization will be done 10 times. After the last number will display the final score of the user. Finally, the design of the glossary as Figure 3e serves as a frame for displaying a list of chemical terms related to electron configuration. This research application was tested on high school students in Medan.



a b c d e

Fig 3. Research design

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3. Result and Analysis

The results of the research are the construction of a chemistry learning application. The resulting learning application is a learning application for the electron configuration of chemical elements. This application can be run on android. The application display as Figure 4 is referred to as the main menu. This form contains the Material, Evaluation, Discussion, and Glossary menus. The Material menu serves to display material regarding the electron configuration. The Evaluation menu serves to display questions regarding electron configuration to test user understanding. The Discussion menu serves to conduct discussions with the application. And the Glossary menu serves to display a list of terms in the field of chemistry in this case regarding the topic of electron configuration.

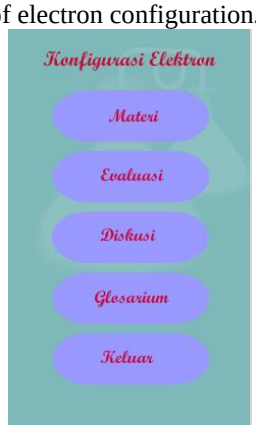
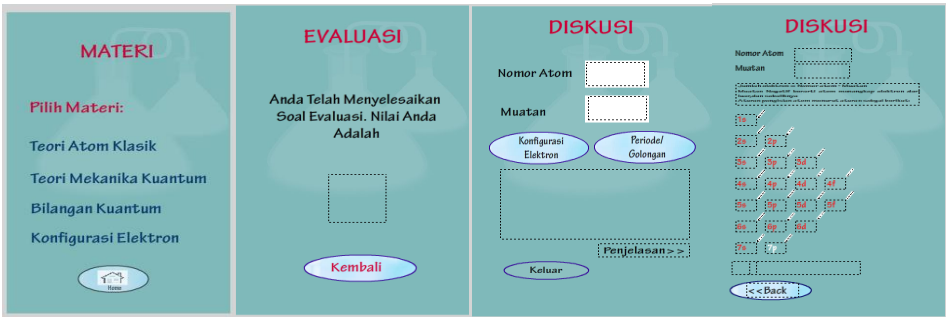


Fig 4. Display of the Application Main Menu

The application topic menu will appear when the user selects the material menu. The display of the Material menu is as shown in Figure 5a. The Evaluation menu is a menu that contains practice questions related to the material discussed in the application, namely the Electron Configuration of Chemical Elements. The source code for the Fisher Yates Shuffle Algorithm uses the Actionscipt 3.0 programming language. like Figure 6. Every time the user presses the 'Next' button, the application will continue to randomize the questions until the 10th evaluation question. At the end of the question, which is the 10th question, the application will display the evaluation result frame. The user will return to the main menu when pressing the 'Next' button on the evaluation result frame. The display of the evaluation result frame is as shown in Figure 5b. The Discussion menu allows users to have discussions with the application. To find out the electron configuration, the user enters the atomic number as well as the atomic charge. When the user presses the 'Electron Configuration' button it will be displayed in the 'Answer' textbox. If the user presses the 'Period/Group' button, the 'Answer' textbox will display the period and group of the element whose atomic number and charge are entered by its use as shown in Figure 5c. If the user presses the 'Explanation' button, the application will display a brief explanation of the electron configuration. The application will display how the order of electron filling is shown in Figure 5d.



a b c d

Fig 5. Research design

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```
function ke_soalselanjutnya(e:Event):void{
        var ran:Number = Math.floor(Math.random() *(30-j));
        trace (ran);
        ran2=ran;
        arrayframe[ran2]=temp;
        for( i = ran2; i<=29-j;i++){
            arrayframe[i]=arrayframe[i+1];
        }
        arrayframe[30-j] = temp;
        j++;
```

Fig 6. Source Code Fisher Yates Shuffle Algorithm

The results of the trial use of the application by students of class XI high school as many as 30 respondents. As many as 20 out of 30 respondents stated that the application design was good. As many as 19 out of 30 respondents stated that using the application was easy. As many as 19 out of 30 respondents stated that the use was helpful in studying electron configuration. As many as 18 out of 30 respondents stated that the application is very feasible to be developed for other materials. From the test results obtained 86% of respondents gave a positive response to the application that was built. Then as many as 60% of respondents expect for further development of other chemistry materials to make learning more interesting and fun.

4. Conclusions

After completing the construction of the software, several conclusions were obtained, namely: (1) the application of learning the electron configuration of chemical elements can be used to assist the learning process for high school students; (2) the fisher yates shuffle algorithm can be applied to applications to randomize numbers; (3) the application is easy to use and can increase the learning interest of students who use it because it is based on Android; (4) the application needs to be added animation to convey learning material so that it makes it even more interesting.

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