Design of Computer Programming Training Based on Online Compiler

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Abstract. This research focuses on design of a computer programming training based on an online compiler. In the digital era, programming skills are in high demand, and online solutions have become increasingly important. Online compilers provide a versatile platform for users to write, execute, and test code without the need for complex installations. This study outlines the comprehensive design process, including needs assessment, the selection of appropriate technologies, and the creation of an intuitive user interface. The system allows users to access a variety of programming languages, compose and run code, and receive immediate feedback through automated code evaluation. The designed training solution aims to enhance programming education by promoting accessibility and interactivity. It empowers learners to experiment with coding in real-time, improving their understanding and problem-solving skills. This research contributes to the advancement of online programming education, offering a user-friendly and effective platform for both novice and experienced programmers.

Keywords: design, training, computer programming, online compiler

1. Introduction

In the world of education, computer programming is not only a useful additional skill but is also a critical component in the Information Technology and Computer Education study program. Computer programming is one of the core skills that Information Technology and Computer Education study program students must have. Several studies explore the role of programming in the ICT curriculum and its implications for improving student abilities [1]. This capability has become increasingly important in this digital era, where information and communication technology has changed the landscape of work and daily life. The digital era has changed the way we live, work and interact [2]. In many aspects of our lives, computer technology and software play a central role. From banking, health services, entertainment, to transportation, computer programming is the foundation that enables development and efficiency in various sectors [3].

Facing this digital era, Information Technology and Computer Education students need to prepare themselves with a deep understanding of computer programming, which will help them be successful in various careers related to technology. Students in the Information Technology and Computer Education study program learn to become software developers,

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network administrators, data analysts, or other Information Technology professionals. The ability to design, develop, and maintain software is a core element in their preparation.

Even though the importance of computer programming is widely recognized, students in the Information Technology and Computer Education study program often face obstacles in learning effective programming. The process of learning computer programming is often faced with challenges, such as access to hardware and software needed for programming practice [4]. Not all students have easy access to adequate computer hardware to practice programming. Additionally, programming software often has high licensing costs, which can be an obstacle for students with limited resources. Other challenges include increasing learning curves where computer programming involves understanding abstract concepts, such as algorithms, data structures, and programming paradigms, as well as less interactive learning methods [5]. Students sometimes have difficulty understanding this concept without adequate guidance. Conventional learning approaches are often less interactive and do not motivate students to learn programming. Learning that only focuses on theory without practical opportunities can make students lose interest [6]

To solve this challenge and improve approaches to learning computer programming, this research introduces the concept of designing computer programming training based on an online compiler. [7] stated that training is a learning process regarding a discourse of knowledge and skills aimed at implementing learning outcomes with certain demands. Online compilers have become an important tool in supporting this approach [8]. They provide a platform where students can write, test, and develop programming code without having to install programming software on a local computer [9].

At a conceptual level, there are clear benefits in adopting an online compiler-based programming training approach. Students can access programming resources more easily and develop programming skills without having to rely on expensive hardware and software [10]. In addition to the online compiler platform, many factors that can influence the effectiveness of programming training, such as learning module design, teaching approach, and instructional support. The study by [11] highlights the importance of structured and interactive design of training materials in supporting effective programming learning.

Designing computer programming training based on an online compiler promises the potential to increase the effectiveness of programming learning among students in the Information Technology and Computer Education study program. Several studies have been conducted to evaluate the effectiveness of online compiler-based training in improving programming skills. Research by [12] shows that the use of online compilers can help students develop a better understanding of programming concepts. In addition, research by [13] shows that the use of online compilers can improve student learning outcomes. The study by [14] discusses the use of BlueJ, an interactive Java programming environment, to support learning Java programming that is easier for students to understand.

2. Method

The research method used in designing online compiler-based computer programming training includes the following steps:

2.1 Needs Analysis

The first stage is to carry out an in-depth analysis of the needs and requirements of students in the Information Technology and Computer Education study program. This analysis aims to understand their current level of programming understanding, the barriers they face, and their expectations for training. Based on the data from this analysis, it will help in designing appropriate and relevant online compiler-based computer programming training content.

2.2 Selection of Online Compilers and Learning Tools

Selection is based on criteria such as ease of use, support of relevant programming languages, as well as the ability to provide practical exercises and programming projects. In addition, an online learning tool was selected that would be used to embed the online compiler.

2.3 Training Module Design

After understanding students' needs and choosing an online compiler, a well-structured training module was designed. This module covers basic programming concepts. The designed module focuses on direct practice and provides practical exercises to strengthen students' understanding of basic computer programming concepts.

2.4 Implementation of Online Compiler Based Training

All training modules are uploaded to the specified online learning platform. The platform is easy to access for trainees and provides intuitive navigation.

2.5 Internal Testing

Before the actual implementation of the training, internal testing was carried out on the training modules and online compiler platform that had been designed. This is done to identify potential technical and content issues that require improvement. This internal testing helps to ensure that all system components are functioning properly before training is introduced to trainees.

2.6 Implementation of Training

The training was carried out by involving students from the Information Technology Education study program as training participants. At this stage, training materials are provided and guidance is provided on how to use the online compiler. During the training process, discussion sessions are facilitated and answers to trainees' questions to ensure a good understanding of the computer programming training material.

3. Result and Discussion

3.1. Result

In designing online compiler-based computer programming training, comprehensive training materials have been successfully developed. This training material covers basic computer programming concepts that are relevant to the curriculum of the Information Technology and

Computer Education study program. The training material is designed with a clear structure, making it easier for students to follow developments in the material. Learning materials are also presented in a structured manner, including relevant code examples, practical assignments, and programming projects. It is designed to provide a holistic learning experience, which includes an understanding of theory and practical application in software development.

This research has also succeeded in selecting the online compiler that best suits the needs of students in the Information and Computer Technology Education study program. The selected compiler supports relevant programming languages and provides an easy-to-use interface. This allows students to easily run their code and see the results directly. This online compiler also allows students to access it from various devices, including personal computers, laptops, or even smartphones. It supports a flexible learning approach that allows students to study anytime and anywhere according to their schedule.

The display of the results of designing online compiler-based computer programming training can be seen in the following section. The training process begins with conveying the performance achievements that must be completed by participants as in Figure 1 below:

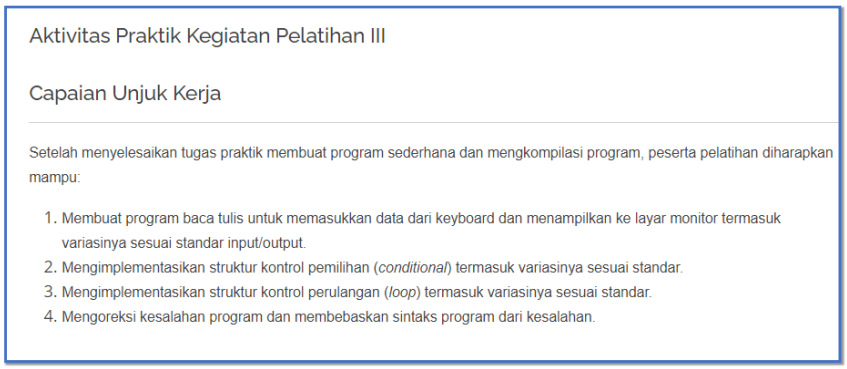

Fig. 1. Display of Performance Achievements

Furthermore, based on these performance achievements, performance indicators are determined as a measure of the abilities that training participants must have after completing practical assignments. Information regarding performance indicators in this training can be seen in Figure 2 below:

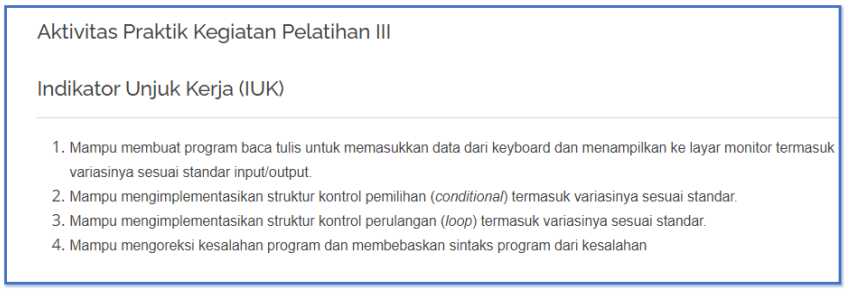

Fig. 2. Display of Performance Indicators

The next stage is given an abstract of practical tasks that will be completed by training participants based on performance achievements and performance indicators. The practical assignment abstract is a description of practical computer programming activities that will be completed using an online compiler. The abstraction section of the practical assignment can be seen in Figure 3 below:

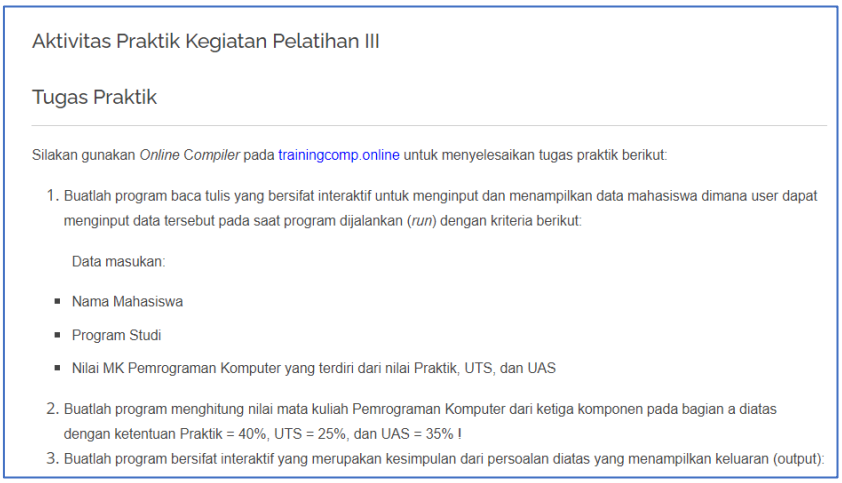

Fig. 3. Display of Abstraction the Practical Assignment

Practical activities to complete the abstraction of practical assignments that have been submitted can be carried out by training participants in the online compiler provided, as in Figure 4 below:

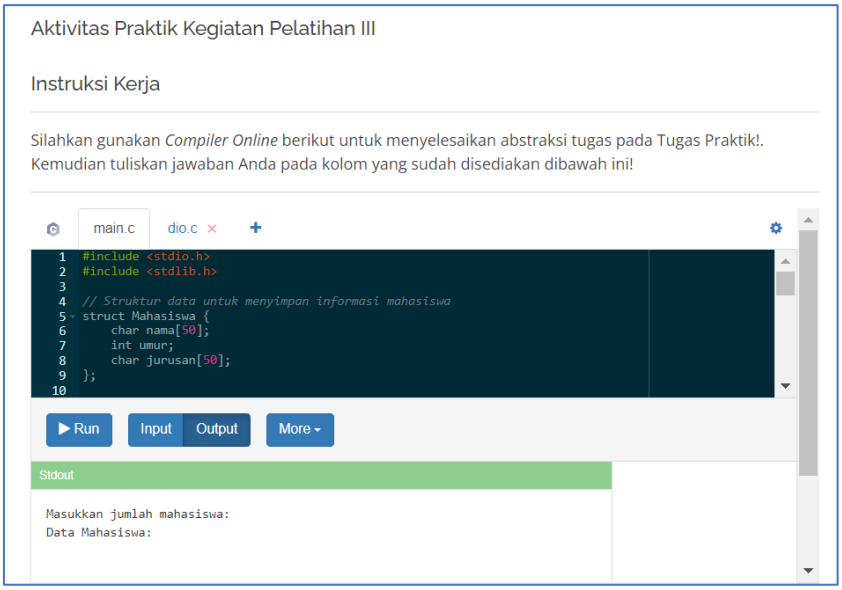

Fig. 4. Practical Activities on Online Compilers

The computer programming training that has been designed can ensure easy accessibility for students. Navigation in this online compiler-based computer programming training is intuitive, allowing students to easily access materials and practical assignments.

3.2. Discussion

A comprehensive training material design approach is a key step in ensuring the effectiveness of online compiler-based computer programming training. Training materials that cover basic computer programming concepts help create a solid foundation for trainees. This approach gives trainees the option to learn programming concepts appropriate to their level of understanding, as well as providing opportunities to explore programming in greater depth. This is important considering that trainees with different backgrounds and skill levels will take part in this training. Additionally, the comprehensive design of training materials allows trainees to experience progression in their understanding of programming over time. Thus, designing comprehensive training materials promotes continuous and continuous learning.

Selection of the right online compiler is an important factor in the success of this training. An online compiler that supports various programming languages and has an easy-to-use interface allows trainees to choose a programming language that suits their interests and needs. The wide selection of programming languages creates flexibility for trainees to explore different languages, which can enhance their understanding of underlying programming concepts. The easy-to-use interface also removes technical barriers that can hinder learning, so trainees can focus on understanding concepts. Additionally, the online compiler's ability to provide immediate feedback on code written by trainees is a significant plus. This immediate feedback helps trainees understand their mistakes and improve their code quickly. This is an important component in effective programming learning.

The implementation of interactive online training creates a collaborative and immersive learning environment. Collaboration on programming projects allows trainees to practice the concepts they learn in real contexts. This approach also allows for more flexible learning. Trainees can access the materials at any time according to their schedule. This flexibility is especially valuable for trainees who have limited time. Furthermore, interactive online training allows trainees to receive direct guidance and support from instructors. This is critical in understanding difficult concepts and overcoming obstacles that trainees may encounter.

This training also provides better readiness for students of the Information Technology and Computer Education study program in facing the challenges of rapidly developing technology. The programming skills gained through this training will be a valuable asset in achieving success in their careers. Apart from that, this training also helps students develop skills that are highly sought after by industry, such as problem solving, logical thinking and creativity. These are qualities that will help students face various challenges in the future.

Although this training design has provided positive results, there is room for further research design. One of them is research on the long-term impact of this training on students' academic and professional success. Additionally, learning content can be updated regularly to ensure that it is always relevant to the latest developments in computer programming. It is hoped that the design of online compiler-based computer programming training will be a positive step in improving the programming skills of students in the Information Technology and Computer Education study program. A comprehensive approach, selecting the right compiler, interactive online learning, and improving programming skills are the key elements that support the success of this training. Thus, this training better prepares students to face the ever-evolving world of technology.

4. Conclusion

This research describes the design and implementation of online compiler-based computer programming training for students in the Information Technology and Computer Education study program. Designing comprehensive training materials covering basic programming concepts allows students to build a strong programming foundation. This is important to support their development in various programming contexts in the future. Selection of online compilers that support multiple programming languages, easy-to-use interfaces, and immediate feedback, help facilitate effective programming learning. This online compiler allows students to practice and apply programming concepts comfortably. This training provides students with better readiness to face challenges in the rapidly developing world of technology. The programming skills acquired are a valuable asset in finding work and progressing in a career in information technology. Thus, this training plays an important role in preparing students to face challenges in the ever-changing technological world.

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