

## DESIGN AND DEVELOPMENT OF PROGRAMMING LEARNING PLATFORM BASED ON HEURISTIC APPROACH IN LIVECODE MODULE WITH ITERATIVE AND INCREMENTAL METHOD

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**Abstract** —Students of computer science in the world have the same problem of learning basic programming. Many of students difficulties in solving the different problems with the same algorithm solution. Students may easier to understand the syntax and intent of the statement coding programming language, however to apply them in the correct program code is difficult. The effectiveness method of learning introductory programming is live code method. In this research discussed on the development of live code method in programming learning platform based on heuristic approach that called CIDE Platform as a solution to help student learn programming easier. This platform can help lecturer to make a live code question with own perspective and student can answer question with live code feature without install anything. For platform development, it used iterative and incremental method made in four iteration by involving business modelling, requirement analysis, analysis and design, implementation, and testing. Platform based web application is built with by using concept Model-View-Template (MVT) which utilize Python programming language within Django Framework and MySQL database. The live code compiler built with by using Java Development Kit and Ace Editor. The result of research is Live Code Module in Programming Learning Platform. For further research, focus development can develop by upgrade the case sensitive, add a type of question livecode can compile or shown to student and free live code area. So, lecturer can make a diverse questions of livecode, such as compare method, check the logic and check a return type. Student can do coding without specific course.

**Abstrak** — Mahasiswa ilmu komputer di dunia memiliki masalah yang sama belajar pemrograman dasar. Banyak dari siswa kesulitan dalam memecahkan masalah yang berbeda dengan solusi algoritma yang sama. Siswa dapat lebih mudah untuk memahami sintaks dan maksud dari pernyataan coding bahasa pemrograman, namun untuk menerapkannya dalam kode program yang benar adalah sulit. Metode efektivitas pembelajaran pengantar pemrograman adalah metode live code atau pendekatan heuristic. Dalam penelitian ini dibahas pengembangan metode live code di platform pembelajaran pemrograman berdasarkan pendekatan heuristik yang disebut CIDE Platform sebagai solusi untuk membantu siswa belajar pemrograman lebih mudah. Platform ini dapat membantu dosen untuk membuat pertanyaan live code dengan perspektif sendiri dan siswa dapat menjawab pertanyaan dengan fitur live code langsung tanpa menginstal apapun. Untuk mengembangkan platform, menggunakan metode iteratif dan incremental dibuat dalam empat iterasi dengan melibatkan pemodelan bisnis, analisis kebutuhan, analisis dan desain, implementasi, dan pengujian. Platform aplikasi berbasis web dibangun dengan menggunakan konsep Model-View-Template (MVT) yang memanfaatkan bahasa pemrograman Python dalam Django Framework dan database MySQL. Live Code compiler dibangun dengan menggunakan Java Development Kit dan Ace Editor. Hasil penelitian adalah Live Code Modul di Pemrograman Belajar Platform. Untuk penelitian lebih lanjut, pengembangan fokus dapat berkembang dengan meng-upgrade case-sensitif, menambahkan jenis pertanyaan livecode dapat mengkompilasi atau ditampilkan kepada siswa dan bebas live code area. Jadi, dosen dapat membuat pertanyaan beragam livecode, seperti metode membandingkan, memeriksa logika dan memeriksa kembali jenis. Siswa dapat melakukan coding tanpa harus mengikuti course tertentu..

**Index Terms**— Live code, CIDE Platform, heuristic , iterative and incremental

### I. INTRODUCTION

Programming course is the main course in learning in the world of information technology. These lessons should be mastered by every student as the main capital in future learning. However programming is not easy to learn. Level of true understanding of a concept of programming is very important [1]

Computer science students are expected to have good programming skills. [2]. Programming algorithm is one skill that has difficulty level to learned [1]. At the level of lower-level programming, the programmer solve a problem and defines it into algorithms, then make a algorithms in syntax of programming algorithm [3]. Based on a survey conducted by E. Lehtinen [1] at 559 programmers at 6 different colleges in Finland, shows that programmers have difficulty in problem solving. Programmer average gain 22.89 points from 100 points in the evaluation of basic programming algorithms. This study shows the problem solving is the hardest part of the programming.

A survey on 188 students in Telkom University, Information System major. 44 % student have a good knowledge of algorithm programming however student confused to answer the question when the lecturer gave a new question problem with same algorithm solution as shown in Figure 1.

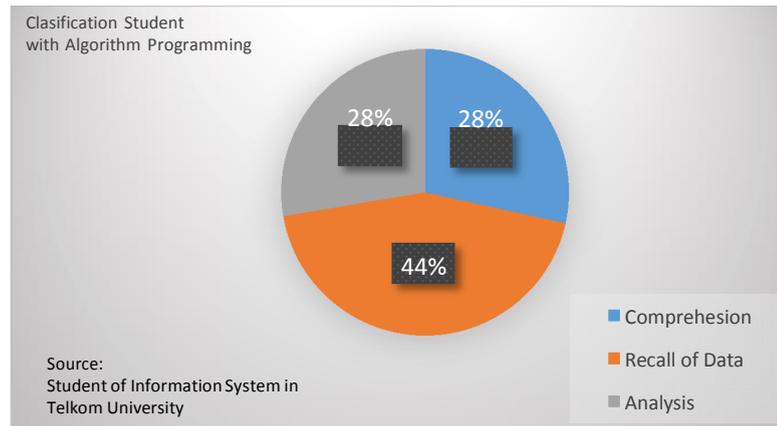


Figure 1 Classification Student in Algorithm Programming

Students may know and understand the syntax and intent of the statement coding programming language to learn, however cannot implement it in a correct program code [4]. It shows that knowledge of the theory of programming is not the main goal of learning programming. However both the theory and practice in the use of the theory.

Live-coding is defined as the process of thinking and implementing a coding during lecturer period in front of class [5]. In this article we present our research design and results regarding the effect different educational requirements, administrative and deployment in platform.

Based on all data above, it will be easier to stimulate student / student to learn programming through learning application that uses a heuristic approach learning with live code features that will help students / lecturer to get feedback directly without waiting time.

## II. LIVE CODE IN PROGRAMMING LEARNING PLATFORM

Live code based on research by Robin [6] provide a high level and abstract literature review of how novice programmers learn programming. Robin create a programming framework (that nicely summarizes the relationships between the cognitive theories and practical issues covered in the literature. The framework can be summarized as follows. To learn how to program, novices need to learn 1) knowledge, 2) strategies, and 3) models of programming.

At this time, there are some live code application based website application that selected cause all of them focus in java platform which is used to in this research i.e. learnjavaonline.org , codingbat.com , javalaunch.com. In this development, this module devoted to lecturer as a creator of question and scenario of course and to student as a main user of the course especially live code features. Comparison between the features of learnjavaonline.org, codingbat.com, javalaunch.com and live code module of this platform that will be developed in this research shown in Table I.1.

Table 1 Previous Application Comparison

No.	Features	Application that use live code			Live code module in this research
		learnjavaonline.org	Codingbat.com	Javalaunch.com	
1.	Add question (lecturer side)	-	-	-	✓
2.	Edit question (lecturer side)	-	-	-	✓
3.	Delete question (lecturer side)	-	-	-	✓
4.	Matching with expected result	✓	✓	-	✓
5.	Use live code online (student side)	✓	✓	✓	✓
6.	Get feedback from compiler (student side)	✓	✓	-	✓

Based on result of these comparisons, the previous applications don't provide features to create a customize question with live code and create expected result. In programming learning platform based on heuristic approach in live code module will be developed features which not available in previous application.

In student side, the features on previous application already provide live code features that needed. However, no one of previous application provide a API or services that can used by the others developer. Therefore in this research, will be developed features which needed in student side.

With the programming learning platform based on heuristic approach in live code module, lecturer will be able to create a customize question with live code and assign a expected result. Student will be able to use a live code features to do task or exercise that created by lecturer

### III. RESEARCH METHODOLOGY

Iterative and incremental method is method development of object-based system. This method is often called a mini waterfall method, although iterative and incremental is different. In iterative and incremental method, user can participate to use a product that still develop and give a feedback.

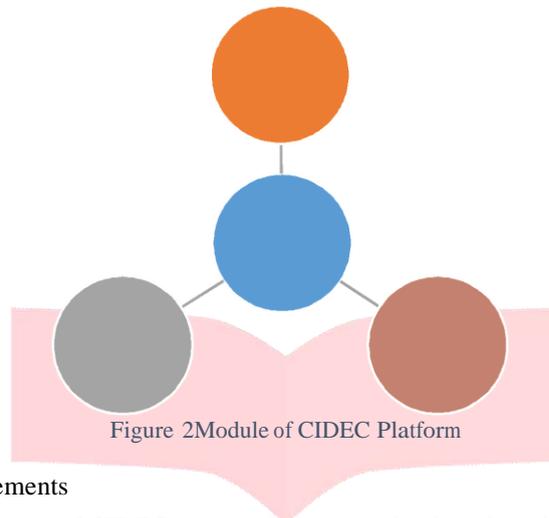
There are phases of iterative and incremental method development :

1. Inception Phase: phase that focuses on defining the scope of applications to be built and the identification of variable application that will be used.
2. Elaboration Phase: phase that process analysis and design the needs of the scope that obtained in the previous phase.
3. Construction Phase: This process is a process of building a system. In this phase possible to conducted iteration to ascertain the result of system appropriate the user need.

Transition Phase: the final phase of the testing process that focuses on user feedback on the features that we have built.

#### IV. SYSTEM ANALYSIS AND DESIGN

Programming learning platform based on heuristic approach called CIDEK. This platform has four modules consists of LMS module, livecode module, assessment module, and gamification module. In livecode module, lecturer can create question of livecode type and then student can solve the problem and answer the question using compiler function that available.



##### A. Functional Requirements

These are the main features of CIDEK (name of programming learning platform based on heuristic approach) in livecode module :

- Java live compiler. The student can find this feature at exercise section after sign in to course. By using this feature, student can compile Java code without IDE or compiler command prompt. When the answer is true, student can pass to next question but when the answer is wrong, student maybe get the clue from the lecturer.
- Make a question of livecode. Lecturer as a user for this feature, can find this feature after make a course. Lecturer can insert answer and question in question form.
- Text Editor. Text editor is a feature that provide a text editor like IDE text editor with auto complete text and line number. This feature will make user easier to type code than text editor form standart.

##### B. Core Business Processes

In livecode module, core business processes will begin when lecturer make a question and answer. After that, student will receive question and must submit the answer for receive a feedback from compiler.

##### C. Application and Technology Architecture

To build platform learning based on heuristic approach for e-learning, it cannot stand alone without centralized database center. That is because this platform need to get validation data in system that already registration in database system. When lecturer and student access platform web server must validate data in database. The web server verified user's data who already registration in system. In lecturer side and student side will access same platform but in different interface.

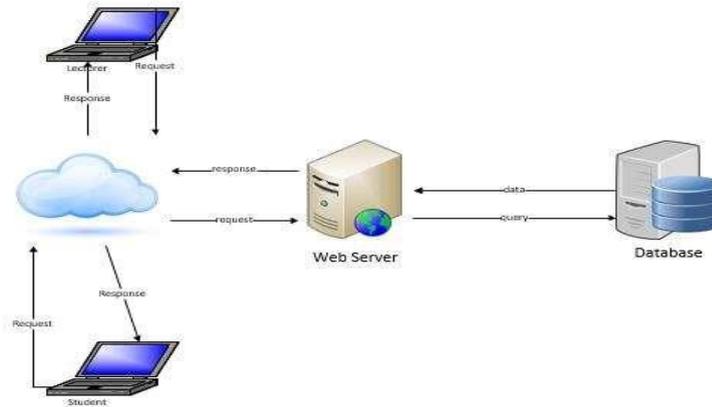


Figure 3 System Architecture

#### D. Result of Application

Interface for livecode module will be shown by the figures below. First figure is a interface of exercise section for student. Student will get CIDECE text editor and description of question.

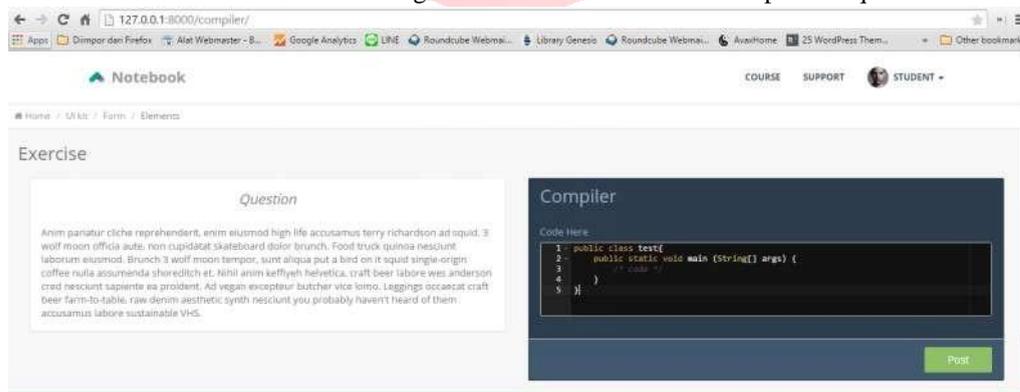


Figure 4 Compiler Student

Second Figure is question form for lecture. Question form will provide column that must fill for submit the question to question bank in database.

The screenshot shows a web form titled 'Add Question'. It contains three input fields: 'Question Name' with the placeholder text 'Type your question name', 'Question Description' with the placeholder text 'Type your question', and 'Answer-key' with the placeholder text 'Type your answer-key'. A green 'Submit' button is located at the bottom left of the form.

Figure 5 Add Question Form

The third interface is table of question that will show list of all question. But just question that made by lecturer

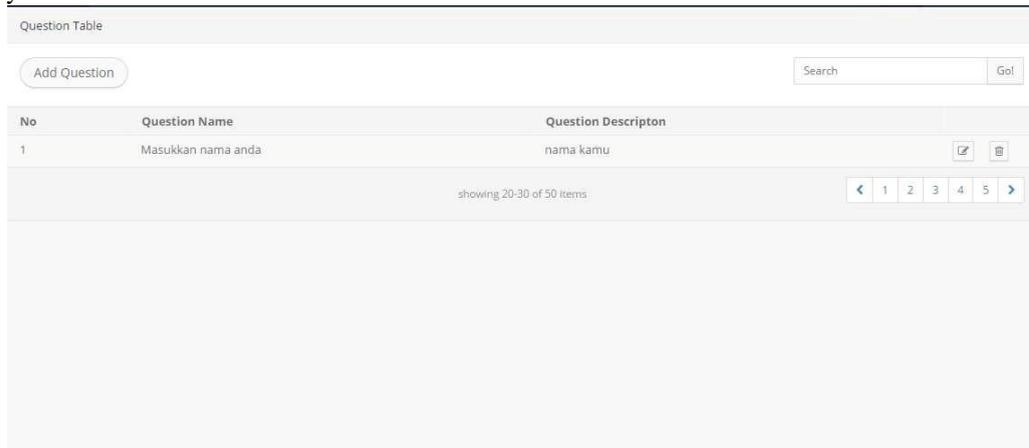


Figure 6 Table of question

### V. IMPLEMENTATION AND TESTING

CIDEC is platform on web based application that need browser application and internet connection to work properly. CIDEC livecode module has been tested to check all of livecode module functions work properly without error.

Test performed on this research use black box testing. The testing result of CIDEC livecode module is shown in Table 1.

Table 2 Test Result of CIDEC Livecode Module

No	Test	Expected Result	Result
1	Add Question and anwer	Can insert question and answer to database and then show question and answer in table of question	Passed
2	Edit Question	Can show existing data and update with new input from edit question form.	Passed
3	Delete Question	Can delete data of question that selected	Passed
3	Show list of question	Show all list of question in table of question	Passed
4	Text Editor Form	Can show compiler field,get a input from text editor and show the result of answer.	Passed

## VI. CONCLUSION

CIDEC Platform Live Code Module is an livecode part of CIDEC Platform that can help student to study from their experience while try to find the right answer. The features of Live Code Module are live coding area, feedback result from compiler, manage question of live code type in lecturer side. When student get material document and the questions, student forcing to practice immediately by live coding area that embeded when question shown. To help forcing student pratice, student must solve the problem/question to pass the exercise or material and continue to assessment section.

With the CIDEC Platform Livecode module, student can do coding or exercise anytime and anywhere as long as student can access the CIDEC Platform. CIDEC Platform already provide compiler in server and student just access the application without install anything to study and try programming course.

In lecturer side, lecturer do not need to check the answer manually, just add the question and answer-key. CIDEC platform will be check it for you anytime when student do exercise.

For further research, focus development can develop by upgrade the case sensitive, add a type of question livecode can compile or shown to student and free live code area. So, lecturer can make a diverse questions of livecode, such as compare method, check the logic and check a return type. Student can do coding without specific course.

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