*Interactive Coding Based On Gamification in Web Programming Course to Increase Motivation Learning for Vocational Students*

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*Abstract*— The Merdeka Curriculum emphasizes flexibility and adaptability in educational practices, allowing educators to tailor learning experiences to meet students' individual needs. However, challenges in its implementation arise when some educators misinterpret this flexibility, continuing to apply uniform teaching methods rather than customizing approaches to enhance student engagement and motivation. This research aims to develop an interactive coding platform based on gamification for a web programming course, specifically designed to increase learning motivation among vocational students.The study employs the Achievement Goals approach to assess students' learning goals and motivations, utilizing the Achievement Goals Questionnaire-Revised (AGQ-R). Students are grouped into categories such as Overachiever, Mastery-Expert, Best-Performance, and Non-Achiever, based on their responses. The research method used is Design Thinking, which includes five phases: empathize, define, ideate, prototype, and test. Material and Media Experts, along with PPLG class XI students, participated as test subjects. The results showed high feasibility of the learning platform, with media validation scores achieving 89.33% ("Good") and material validation scores reaching 90.67% ("Very Good"). User testing yielded a feasibility score of 82.78% ("Good"). These findings suggest that the gamified interactive coding platform is highly effective and suitable for enhancing motivation and learning in vocational education.

Keywords—Gamification, Interactive Learning, Vocational Education, Coding Motivation, Web Programming Course.

# Introduction

Education is a continuous process aimed at developing individuals' potential in alignment with cultural values and societal goals. It encompasses not only cognitive development but also the physical and emotional growth of students, all of which are integrated within the curriculum to guide learning in schools [1][2]. A well-structured educational environment, equipped with appropriate facilities and resources, is essential for achieving educational objectives effectively [3].

In response to the evolving educational landscape, the Merdeka Curriculum has been introduced in Indonesia to offer flexibility in the learning process. This curriculum is designed to adapt teaching methods to the specific needs of learners, thereby enhancing the quality of human resources capable of competing globally [4]. However, challenges such as limited infrastructure, technology access, and teacher preparedness continue to hinder its effective implementation [5][6].

In Vocational High Schools (SMK), particularly in the Software Engineering field, web programming courses are vital. These courses help students acquire technical skills that meet industry demands, including application and website development using technologies like HTML, CSS, JavaScript, and various web frameworks [7]. Mastery of these skills not only improves students' employment prospects in roles such as web developers and designers but also enhances their analytical and problem-solving abilities.

To further engage students and enhance their learning experience, integrating gamification into web programming education is increasingly relevant. The Achievement Goals approach, which categorizes students based on their learning orientations—such as Overachiever, Mastery-Expert, Best-Performer, and Non-Achiever—provides valuable insights into their motivation levels [8]. By combining this approach with gamification elements like points, levels, and leaderboards, learning becomes more interactive and enjoyable, thereby increasing motivation and engagement.

Developing an interactive coding platform that incorporates both gamification and the Achievement Goals approach presents a novel solution to enhance learning motivation among vocational students. This web-based learning medium not only offers flexible and practical access to web programming courses but also fosters a more personalized and effective educational experience. Such innovations are crucial for preparing students in the field of information technology to thrive in a competitive job market [9]. The implementation of this interactive, gamified platform is expected to significantly boost students' skills and motivation, equipping them for future challenges in the tech industry.

# LITERATURE REVIEW

## Merdeka Curriculumn

In education, there is a curriculum that functions as an educational guide that contains learning objectives and the content of learning activities for learning at school[6]. The curriculum has an important role in education which aims to achieve educational goals. Based on the development of time from time to time, the curriculum is also developed to meet educational needs. Curriculum changes are made in an effort to improve the quality of education and create an Indonesian generation with better human resources and able to compete with other countries[10]. The Merdeka Curriculum is an educational approach designed to provide freedom and flexibility in organizing the learning process by adjusting the needs of students. Education has a major impact in preparing and developing human resources (HR) who are knowledgeable and able to compete in world challenges. This curriculum presents new guidelines that empower institutions and students in carrying out the learning process [4]

## Achievement Goals

Achievement goals represent a psychological construct whereby individuals possess distinct learning objectives influenced by their self-perception of abilities[11]. Subsequently, Elliot and McGregor formulated a conceptual model termed the 2x2 Achievement Goal Framework[12]. Elliot classified each category into two motivational orientations: individuals who are driven to attain success (approach) and those who strive to evade failure (avoidance). This classification yields four distinct categories of achievement goals: mastery approach, mastery avoidance, performance approach, and performance avoidance.

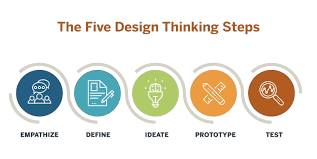
In order to assess and classify achievement goals, Elliot and McGregor created an evaluative tool referred to as the Achievement Goal Questionnaire (AGQ). This instrument comprises 12 items, with three items allocated to each goal category. However, in a subsequent investigation conducted in 2008, Elliot and Murayama made revisions to this instrument, subsequently designating it as the Achievement Goal Questionnaire-Revised (AGQ-R)[13].

## Web Learning

Web learning is a learning method that uses the Web and its various services as materials in various learning activities. Fully online learning is implemented through one of the web services, where curriculum and learning activities are conducted online, and there is blended learning or smart learning. As computers and networks become more popular, web learning (e-learning) has become a more practical and globally accepted approach [14].

# METHOD

This research is a type of development research using the Research and Development (R&D) method that produces a learning media product with the Design Thinking development model. This research uses the Design Thinking method which involves users and stakeholders directly to define problems, sharpen the exploration of the problem context, determine development priorities, find opportunities for differentiation innovation and competitive advantage[15]. The Design Thinking process has 5 (five) stages including: Empathize, Define, Ideate, Prototype, and Test.



**Fig 1**. Design Thinking Development Flow

## Empathize

At this stage it will be done to get an empathetic understanding of the problem that is trying to be solved. At this stage, data collection will be carried out by exploring user problems using the interview method[16].

## Define

In the Define phase of Design Thinking, observations will identify core problems from a human-centered perspective and gather information about the features and functions required for effective system design. According to[17]. this process is essential to identify the specific needs and challenges faced by the intended population, which is aligned with the principles of human-centered design. Here, observations will be made and synthesized to determine the core problems that have been identified in a human-centered way.

## Ideate

The Ideate phase of Design Thinking is crucial for generating innovative solutions to identified problems and relies heavily on techniques such as brainstorming, which involves structured activities designed to encourage creative thinking among participants. In practice, brainstorming sessions can be enhanced by utilizing mind maps, which visually organize information and facilitate the ideation process[18].

## Prototype

In the methodological process of conceptualization and design, utilizing prototypes that can interact with users is essential for effective user engagement and feedback. The complexity of the technology determines the level of interaction required from the prototype, emphasizing the need for user feedback to refine the design[19].

## Test

At this step, the implementation and testing of the product can be carried out by media expert and material expert validators. This is particularly important for content verification, as it ensures the authenticity and accuracy of the material being tested. Ultimately, these technological advancements facilitate a comprehensive approach to product implementation, enabling thorough trials conducted by media expert and subject matter expert validators, thus fostering a more trustworthy digital content ecosystem.

The design of developmental product trials effectively utilizes descriptive design methodology, primarily through a focus on needs analysis and field testing. This approach is supported by descriptive methods and techniques that analyze and evaluate design performance, ensuring that needs analysis is thoroughly addressed. The trial was conducted in two stages, namely expert trials and user trials. Expert trials were conducted for material and media validation, while user trials were conducted on students of SMK Negeri 12 Malang City class XI Software and Game Development (PPLG).

TABLE I. DATA COLLECTION INSTRUMENTS

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Method** | **Scoring Scale** | **Data Type** |
| Needs Analysis | Interview | Qualitative | Qualitative |
| Media Expert Validation | Questionnaire | Interval | Quantitative & Qualitative |
| Material Expert Validation | Questionnaire | Interval | Quantitative & Qualitative |
| User Test | Questionnaire | Interval | Quantitative |
| Learning Interest Test | Questionnaire | Interval | Quantitative |

From the results of data processing carried out, it will be compared according to the criteria for media and material feasibility can be seen in the table below. To determine the validation of functionality using the criteria as below. Then, the processed data on learning motivation is compared with the criteria for motivation level.

TABLE II. MEDIA FEASIBILITY CRITERIA

|  |  |  |
| --- | --- | --- |
| **Percentage (%)** | **Feasibility Score** | **Description** |
| 90% - 100% | Very good | no need for revision |
| 75% - 89% | Good | needs little revision |
| 65% - 74% | Fairly Good | revised sufficiently |
| 55% - 64% | Not Good | needs more revision |
| 0% - 54% | Not very good | Not suitable for use and needs revision |

TABLE III. MOTIVATION LEVEL CRITERIA

|  |  |
| --- | --- |
| **Percentage (%)** | **Category** |
| 81 - 100 | Very high motivation |
| 61 - 80 | High motivation |
| 41 - 60 | Moderate motivation |
| 21 - 40 | Low motivation |
| 0 - 20 | Very low motivation |

# RESULT AND DISCUSSIONS

## Empathize

1. *Learning Analysis*

At this point, the data collection process will be implemented by investigating user challenges using interview techniques[16]. Interviews were conducted with PPLG teachers at SMKN 12 Malang who teach web programming materials to gain a deeper insight into learning methods, educational resources, and the level of achievement regarding student learning objectives. In addition, discussions were held with selected PPLG class XI students to ensure a comprehensive picture of the problem from the students' perspective and to investigate their expectations regarding the web programming learning experience.

1. *Problem Analysis*

Through the learning analysis, the results show that there are several problems including: (1) Learning methods carried out by educators are less adaptive, (2) Unattractive learning media makes students less motivated to learn, (3) Lack of availability of interesting and easy-to-understand teaching materials that can increase student learning motivation, (4) Lack of teaching materials on web programming material.

1. *Needs Analysis*

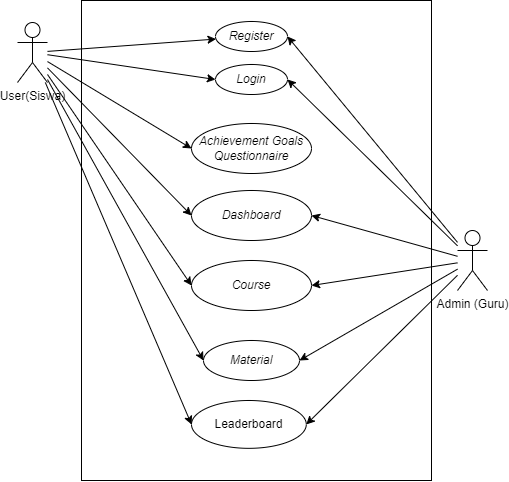
Based on the results of the problem analysis that has been carried out, the objectives of this study can be formulated, namely to develop website-based interactive learning media on web programming material to increase learning motivation based on student learning goals and make it easier for students to access learning anywhere and anytime.

## Define

The problem solution based on the previous analysis is determined through problem solving by developing learning website media based on student learning goals and motivation. Determination of student learning goals through the AGQ-R questionnaire that adapts to student learning goals to increase learning interest. This stage resulted in the following formulations: (1) Website-based learning media on web programming material, (2) Adaptive learning media adjusts student learning goals and motivation, (3) Learning media that can be accessed and used anywhere based on the internet.

## Ideate

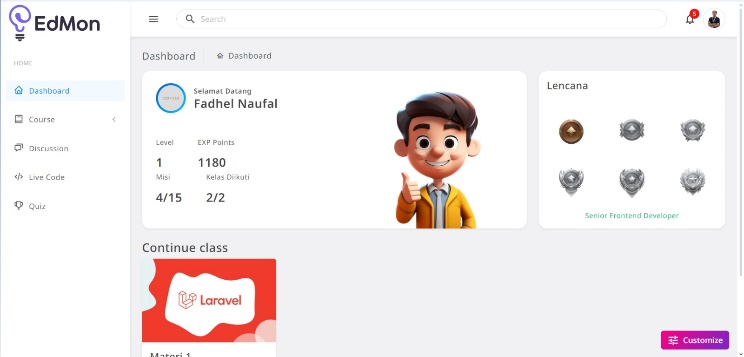
During the ideate stage, create a use case diagram. A use case diagram is a tool for describing applications that is used to describe the interaction between users or actors and software systems[20]. The purpose of a use case diagram is to describe the functionality of a system from the user's point of view and to show how the user interacts with the system in a scenario.



**Fig 2**. Use Case Diagram

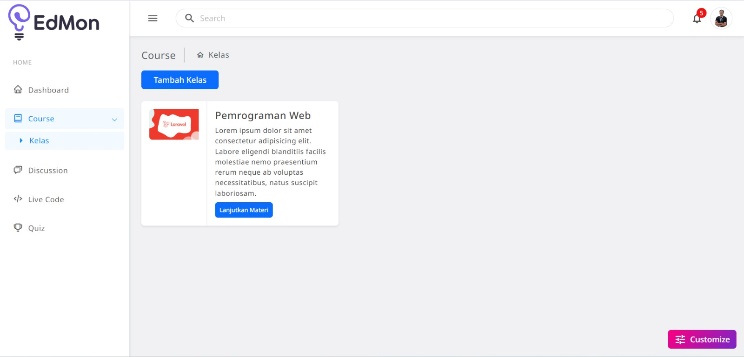
## Prototype

This learning media development uses the PHP Laravel 11 framework with the help of the Visual Studio Code text editor. Making image assets and design using Figma and Adobe Illustrator software. This media is in the form of a website that can be accessed multi-platform all devices such as desktop and mobile devices online anywhere and anytime when connected to the internet.



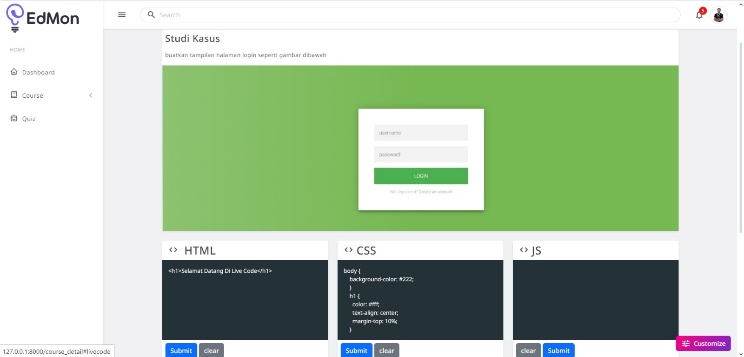
**Fig 3**. Dashboard page

The dashboard shown in the figure 3 shows the students detail user (1) badge, (2) course that has been enrolled (3) students statistics.



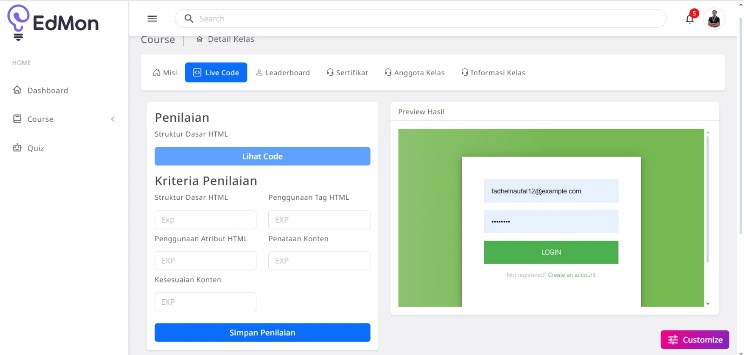
**Fig 4**. Courses menu

The course menu shown in figure 4 show which courses are available for the students.



**Fig 5**. Live code study case

Live code study case that’s on figure 5 shows the study case that the students need to complete like creating a login page and ect.



**Fig 6**. . Live code Assesment

After the live code study case there is the assesment for the job that the students have been submitted shown in the figure 6 that showns in the form of a score.

## Test

Researchers collected data to assess feasibility through testing to media and material experts, namely PTI UM lecturers and SMKN 12 Malang teachers. Furthermore, testing was carried out on the subject of SMKN 12 Malang students majoring in PPLG. The process resulted in the following data.

### Media validation test data

### **TABLE V. MEDIA VALIDATION RESULTS**

| **Aspect** | **Score** | **Max Score** | **Validation (%)** | **Criteria** |
| --- | --- | --- | --- | --- |
| Attractiveness | 57 | 60 | 95.00 | Very Good |
| Perspicuity | 82 | 90 | 91.11 | Very Good |
| Efficiency | 76 | 90 | 84.44 | Good |
| Dependability | 64 | 75 | 85.33 | Good |
| Stimulation | 55 | 60 | 91.67 | Very Good |
| Novelty | 68 | 75 | 90.67 | Very Good |
| **Total** | 402 | 450 | **89.33** | Good |

The media validation results indicate that the learning media on the EdMon website is of high quality, with an overall score of 89.33%, falling into the "Good" category. This suggests that the media developed for the platform meets the expected standards and is ready for further trials.

### **TABLE VI. MATERIAL VALIDATION RESULTS**

| **Aspect** | **Score** | **Max Score** | **Validation (%)** | **Criteria** |
| --- | --- | --- | --- | --- |
| Content | 58 | 60 | 96.67 | Very Good |
| Language | 41 | 45 | 91.11 | Very Good |
| Presentation | 79 | 90 | 87.78 | Very Good |
| Evaluation | 94 | 105 | 89.52 | Very Good |
| **Total** | 272 | 300 | **90.67** | Very Good |

The material validation shows that the learning materials on the EdMon website are of very high quality, with a total validation score of 90.67%. This places the materials in the "Very Good" category, indicating that they are suitable for educational purposes and ready for implementation.

### **TABLE VII. USER TEST RESULTS**

| **Aspect** | **Score** | **Max Score** | **Validation (%)** | **Criteria** |
| --- | --- | --- | --- | --- |
| Material | 290 | 345 | 84.06 | Good |
| Learning Design | 482 | 575 | 83.83 | Good |
| Learning Media and Communication | 662 | 805 | 82.23 | Good |
| Implementability and User Response | 470 | 575 | 81.74 | Good |
| **Total** | 1904 | 2300 | **82.78** | Good |

The user testing results demonstrate that the EdMon website's overall material and design are effective, with a total validation score of 82.78%, categorized as "Good." This confirms the platform's adequacy as a learning tool and supports its use in educational settings.

### **TABLE VIII. MOTIVATION LEVEL RESULTS**

| **Aspect** | **Score** | **Max Score** | **Validation (%)** | **Criteria** |
| --- | --- | --- | --- | --- |
| Attention | 555 | 690 | 80.43 | High |
| Relevance | 380 | 460 | 82.61 | Very High |
| Confidence | 640 | 805 | 79.50 | High |
| Satisfaction | 287 | 345 | 83.19 | Very High |
| **Total** | 1862 | 2300 | **80.96** | Very High |

Motivation level results show that the learning media on the EdMon website significantly enhances student motivation, with an overall score of 80.96%, classified as "Very High." The highest scores were in the relevance and satisfaction aspects, indicating strong user engagement and positive feedback.

##### V. CONCLUSION

Based on the research findings, it can be concluded that the interactive coding platform, designed with gamification elements, is highly suitable for enhancing learning in web programming courses for vocational students. The platform's feasibility was validated by material and media experts, achieving a total validation score of 91.33%, categorized as "Excellent," and 89.78%, categorized as "Good." User trials with PPLG XI class students resulted in a total score of 83.48%, also within the "Good" category. These results indicate that the platform is not only effective but also highly engaging, making it an ideal tool for learning web programming. The gamified approach increases student motivation and provides a flexible, accessible learning resource that students can use anytime and anywhere. This innovative platform can serve as a primary learning tool, particularly beneficial for vocational students aiming to strengthen their web programming skills in a dynamic and interactive environment.

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