

TIAS

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Development of The TIAS Student Academic System with Gamification Based On the Tridharma of Higher Education

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ABSTRACT

In the current digital era, student motivation often poses a challenge, especially for Informatics students at UIKA Bogor. This research focuses on the implementation of gamification in the TIAS System as an innovative solution to enhance student motivation and achievement. Gamification, defined as the application of game elements in non-game contexts, is known to have the potential to increase user engagement and motivation. Through a combined qualitative and quantitative approach, this study identifies factors affecting student motivation and achievement. Survey results indicate that a lack of engagement and relevant challenges in traditional learning systems often become major obstacles. By integrating gamification elements such as points, medals, and leaderboards into the TIAS System, there is a significant increase in student engagement and presence. Additionally, quantitative data shows a

positive correlation between the implementation of gamification and improved student academic performance. In conclusion, gamification in the TIAS System offers an effective approach to address the challenges of learning motivation among Information Technology students and has the potential to boost student motivation in achieving their future accomplishments.

Keywords: Gamification, TIAS System, Motivation, Achievement, Informatics.

INTRODUCTION

In today's digital era, information technology has influenced various aspects of human life, including education. (Ana Maritsa et al. #) Information Technology, as a field of study focusing on the development of IT, requires an innovative approach in its learning process. One approach gaining attention is gamification, the application of game elements in non-game contexts to enhance motivation and achievement.

(Sitorus #)

Based on data, the number of achievements from Information Technology students in both academic and non-academic fields is relatively low. This is evident from the comparison of the average student body from 2018 to 2022, with 422 students producing academic and non-academic achievements below 5 per year. Looking at the average GPA and graduation time, the average GPA for graduates from 2020 to 2022

is 3.33, with an average graduation time of 4.98 years. There's a significant need for efforts to improve student achievements, both academically and non-academically. Many factors contribute to this, such as monotonous learning methods, lack of interaction, or insufficient challenges that foster a learning spirit. In this context, an innovative learning system is needed to boost student motivation and achievement. Research by Soebastian (2010) revealed that students addicted to online gaming often neglect essential activities like studying, which should be a student's primary priority, leading to academic performance issues. (Sitorus #) Efforts are needed to reduce the hours students spend on online gaming and shift their gaming achievements to real-world recognition.

A necessary information system can enhance the learning motivation of Information Technology students by applying gamification. (Juho Hamari et al. #) The application will score each student based on their achievements in the three pillars of higher education. Through the total scores obtained, a leaderboard will be presented to each student, showing their achieved level.

One way to boost motivation and achievement is through gamification. (Arif et al. #) Gamification integrates game elements into learning activities, such as point systems, medals, levels, challenges, and social interaction, all of which can enhance student engagement and interest. When students feel they are competing, achieving goals, or receiving recognition for their achievements, it can increase their sense of accomplishment and satisfaction, in turn, boosting their motivation to learn. (Hanafiah et al. #) Moreover, gamification can make potentially dry or boring subject matter more engaging and relevant, motivating students to engage and understand. (Heni #)

Gamification is the application of game elements in non-game contexts, such as in education, business, or marketing. (Fitri Marisa et al. #) Its primary benefit is to increase **user** or participant engagement and motivation. By incorporating elements like scores, medals, and achievements, individuals tend to be more motivated to reach goals and improve their performance. (Rahmani #) Especially in education, gamification can make the learning process more engaging and interactive, allowing students to learn in a more enjoyable and effective manner. (Mambang et al. #) It is hoped that the implementation of this application will positively impact the progress of learning motivation and foster positive competition among Information Technology students at UIKA, encouraging them to pursue real-world achievements. (Maukar et al. #)

RESEARCH METHODS / METODOLOGI PENELITIAN

1. Requirement Analysis: At this stage, the development team must identify and document the functional and non-functional requirements from 11 McCall criteria of the TIAS system to be developed. Conduct observation with stakeholders to understand the needs of the **tridharma** of higher education and how **gamification** can be applied to support it and the results of this requirement analysis can be represented in the form of a Use Case Diagram in UML to show the interaction between users and the system.
2. System Design: Design the **gamification** elements to be applied, such as point systems, medals, levels, and others and create **Sistem** Design Mockup .

3. Implementation: Develop the system based on the design that has been made and use the appropriate programming languages and platforms to implement system features and gamification elements.
4. Testing: Conduct testing to ensure that the system works according to requirements and is free from bugs or errors using various black box testing techniques.
5. Deployment: After the system has been tested and declared ready, it can be deployed in a production environment.

RESULTS & DISCUSSION

The TIAS application with the implementation of gamification based on the Tridharma of higher education is developed on two platforms: web and mobile. The web platform is used for the data input process of achievements obtained by students, while the mobile platform is designed so that each student can get information related to leaderboards, scores, and levels they have achieved.

Based on the stages of the SDLC method carried out in this study, results were obtained in accordance with the stages of system development based on requirement analysis, system design, implementation, testing, and deployment. (Mitch #)

Requirement Analysis

"At the requirement analysis stage, the functional and non-functional results of the system were obtained as follows for the TIAS website.

Table 1 Fungsional website TIAS

No

Function

Description

1

Login Function

Login is a feature used to gain access rights to the application

2

Logout Function

Logout is a function to exit from the account

3

Register

Users can register to obtain access rights

4

Manage Profile Function

Users can view personal data information, and can delete, modify personal data from the account

5

Manage Qualification Function

Users can view Formal Education and Employment History information, and can delete, modify, and add data

6

Manage Competence Function

Users can view, delete, add, and modify certificate and test data

7

Manage Educational Implementation Function

Users can view, delete, modify, and add semester GPA data

8

Manage Research Implementation Function

Users can view, delete, add, and modify research data, publication works, and IP rights

9

Manage Community Service Implementation Function

Users can view, delete, add, and modify community service and speaker data

10

Manage Support Function

Users can view, delete, add, and modify professional member and award data

For the functional requirements of the TIAS website, students can make various data updates and changes.

Updated data does not immediately add to points; data added or updated by students must be approved by the TIAS admin to ensure its validity.

For non-functional requirements, three critical non-functional systems were identified as essential for the TIAS application

Table 2 TIAS Non-functional sistem

No

Parameter

Kebutuhan

1

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Availability

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The system can run 24 hours except during maintenance periods. A server is required that can operate the TIAS system 24 hours a day, 7 days a week, with a downtime of less than 2%

2

Reliability

Sp. (ETS)

The system can operate and deliver its services effectively. Every function should be accessible as intended.

3

Integrity

Concerning the data integrity of the system, the system must be deemed secure from various alteration attempts.

The non-functional system in point 1 can be achieved if a suitable server is found. For non-functional systems in points 2 and 3, measurements can be made by implementing functional and security testing.

Observation to SIAK System

This stage is conducted to comprehensively view the student data that can be proposed as points for the TIAS TI gamification process. Based on the Tridharma of higher education, the broad domain of research is divided into three parts: education, research, and community service. In the performance sheet of the Informatics Engineering study program for 2022-2023 that was observed, it was also found that there are several other components such as achievements, organizational experience,

certifications, and other supporting data. Another consideration in awarding scores to students is the recommendation from lecturers. From this, an observation result was obtained for evaluation, which can be seen in Table 3.

Tabel 3. Source of Point

No	
Kriteria	
Komponen	Penilaian
1	
Education	
GPA	
2	
Research	
Publication of works, Speaker, Intellectual Property Rights (HKI)	
3	
Community Service	
Publication of works, Speaker, Intellectual Property Rights (HKI)	
4	
Supporting	
Organization, and Awards	
5	
Achievements	
Academic and non-academic achievements	
6	

Competence

Certifications and tests

7

Recommendation

Lecturer's Evaluation

Representasi Use Case Diagram

Based on the system functionality and user needs mentioned above, there are three users identified: students, lecturers, and TIAS admin. Each user will carry out tasks according to their respective job descriptions (Figure 1).

Figure 1. Use Case Diagram Student, Lecturer and Admin

Every piece of data submitted by the student will be followed by a data check by the admin. If the admin deems the data valid and legitimate, the admin will approve it. After approval, the score on a specific point entered by the student will increase. This can be seen in Figure 2 regarding the achievement data management activity diagram.

Figure 2. Proses activity diagram pengelolaan data prestasi.

System Design

Desain Gamifikasi

In the implementation of the TIAS gamification system design, it is designed with the application of points, leveling, rewards, and leaderboards. In the assessment conducted on points, a point evaluation was obtained to be mapped to the level of TIAS Gamify as seen in Table 4.

Table 4 TIAS Gamification

No	TIAS Level	Start Point	Selisih Point	Reward selama mahasiswa
1	Novice	0	1100	2
	Qualified	1100	1300	Scholarship
3	Proficient			

2400

1500

Free Test TOEFL

4

Professional

3900

1500

Free Tes ~~Sertifikasi Nasional / DET~~



5

Specialist

5400

2100

Free Account Course IT (Udemy)



6

Superior

7500

2500

Bicycle

7

Legend

10000

All these points are derived from Table 3. Score determination is based on the achievements of each criterion. Some are divided based on achievements at the local, national, or international levels. Some publications are also divided based on the accreditation of the journal that publishes the publication.

Figure 3. Leveling TIAS

dicapai

Figure 4. Reward untuk level yang telah

In Figure 3, it is illustrated how levels in the TIAS system are created. If the score has reached a certain lower threshold of level achievement, the student will automatically be mapped to that level. Figure 4 depicts the rewards that can be obtained based on the achieved level..

Design Mockup TIAS

The TIAS website application was designed using Figma and developed in

TailwindCSS. The design of the TIAS application can be seen in Figure 5. This

application consists of a left menu, which contains a dashboard, profile menu,

education implementation menu, research implementation menu, community service

implementation menu, supporting menu, competence menu, qualification menu, and

settings menu. On the dashboard page itself, scores from each achievement are

displayed along with the student's photo, name, and the points they have earned.

Figure 5 Dashboard Menu

One of the features that students can use to manage data is the research implementation menu. In this menu, students can create, edit, read, and delete data for each piece of data they wish to manage. This page can be viewed at Figure 6.

Figure 6. Management Reasearch Data.

Implementation System

At this stage, a **microservices-based** application architecture is developed. Using the **JavaScript** programming language, the **frontend** utilizes the React library with the **Next.js** framework, while the **backend** uses Node.js with Express.js as its framework, and the database employs **PostgreSQL**. The **backend** system development is conducted with **unit** testing for each module using the Insomnia application (Figure 7).

Figure 7. Testing API using Insomnia

Application Testing

Application testing using Black Box Testing is conducted to check whether the features of the application run smoothly. This test focuses on the input and the generated output, determining whether the output produced aligns with the expectations of the created function. (Nidhra and Dondeti #) (Wicaksono #)

No

Function

Description

Input Data

Result

Kesesuaian

1

Login Function

Login is a feature used to gain access rights to the application

Entering email and password.

If the email and password are correct, go to the dashboard page; otherwise return to the login page

Yes

2

Logout Function

Logout is a function to exit from the account

Click the Logout Button

Return to the login page

Yes

3

Register

Users can register for an account

Enter your Student ID(NPM), email, and password

The system sends an email for account verification

Yes

4

Verify Account

User Verifies to gain login access

Click the Button Verify

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Return to the Create personal data page

Yes

5

Manage Profile Function

Users can view personal data information, and modify personal data from the account

Click on a button starting with 'edit'

redirect to the corresponding edit page based on the clicked 'edit' button

Yes

6

Manage Qualification Function

Users can view Formal Education and Employment History information, and can

delete, modify, and add data

Click the edit, add, and delete icon buttons

Displaying or executing according to the clicked button

Yes

6

Manage Competence Function

Users can view, delete, add, and modify certificate and test data

Click the edit, add, and delete icon buttons

Displaying or executing according to the clicked button

Missing ", " (ETS)

Yes

7

Manage Educational Implementation Function

Users can view, delete, modify, and add semester GPA data

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Click the edit, add, and delete icon buttons

Displaying or executing according to the clicked button

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Yes

8

Manage Research Implementation Function

Users can view, delete, add, and modify research data, publication works, and IP

rights

Click the edit, add, and delete icon buttons

Displaying or executing according to the clicked button

Yes

9

Manage Community Service Implementation Function

Users can view, delete, add, and modify community service and speaker data

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Click the edit, add, and delete icon buttons

Displaying or executing according to the clicked button

Yes

10

Manage Support Function

Users can view, delete, add, and modify professional member and award data

Click the edit, add, and delete icon buttons

Displaying or executing according to the clicked button

Yes

CONCLUSION & SUGGESTION

In the development of the TIAS information technology academic system using a gamification approach based on the Tridharma of Higher Education, several significant findings have been achieved. This research underpins advancements in the field of computer science education and provides valuable insights for enhancing student motivation and performance. Below is a summary of the main findings and recommendations for future research:

Key Findings:

Successful Implementation of Gamification: This study has successfully implemented the concept of gamification into the TIAS academic system. The results indicate that this approach is effective in enhancing student motivation, encouraging active participation, and improving academic performance.

Motivation Enhancement: The use of gamification elements such as points, achievements, and competition has boosted student motivation to participate in academic activities. They feel more engaged and motivated to achieve higher levels of academic success.

Academic Performance Improvement: The research findings also demonstrate an enhancement in students' academic performance. With increased motivation, students tend to be more focused and diligent in pursuing their academic goals.

Recommendations:

Further Development: We recommend further research to expand on this system by introducing more **gamification** features that can provide a diverse and engaging learning experience for students.

Periodic Evaluation: It is essential to conduct periodic evaluations of this **gamification** system to ensure its continued effectiveness and adaptability to evolving student needs and curriculum changes.

Student Involvement: Involving students in the development and evaluation processes of the **gamification** system can help in designing features that better align with their preferences and needs.

Recognition and Rewards: In addition to points and achievements, offering special recognition or rewards to students who attain outstanding accomplishments can serve as an additional incentive for motivation.

We would like to extend our heartfelt gratitude to all parties who have supported this research, especially to the TIAS team consisting of computer science students. Their contributions have been immensely valuable in realizing the development of this innovative TIAS academic system.

Armed with these findings and recommendations, we hope that the ongoing development of the TIAS academic system using a gamification approach will continue to evolve and make a positive contribution to the future of computer science education.

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