



#ST22



A Support System for Programming Exercises Using Test-first Approach

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on Advanced Applied Informatics (IIAI-AAI)



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Agenda

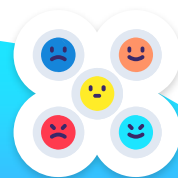
- 01 Introduction
- 02 Test-first Approach
- 03 Methodology
- 04 Result and discussion
- 05 Conclusion





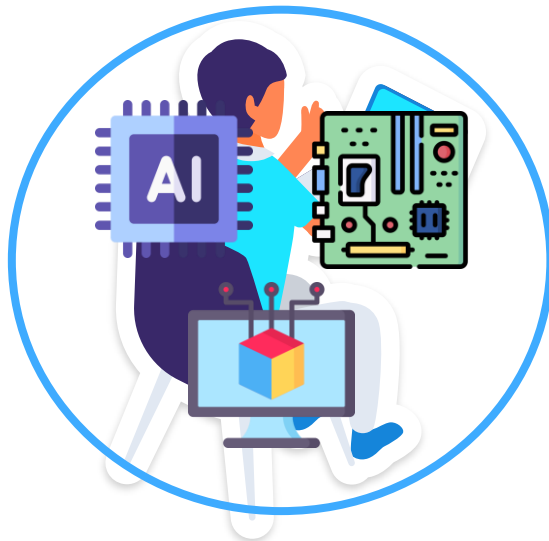
01

Introduction





Learning Programming



Technology

01 Introduction

02

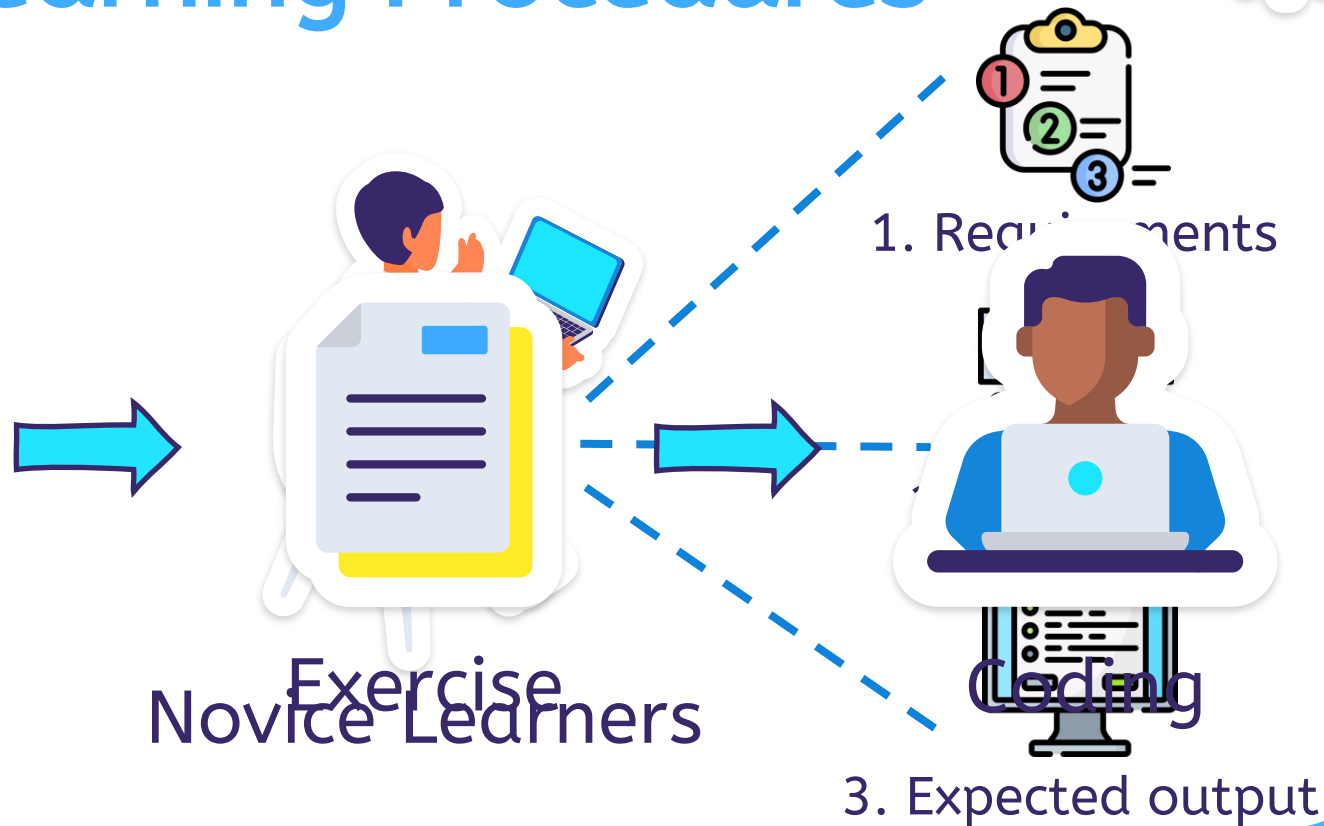
03

04

05

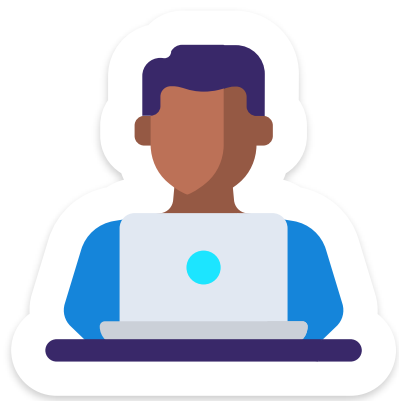


Learning Procedures

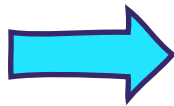




Learning Procedures



Coding



Testing



Learning Procedures



Testing



Input data

Enter data



Output

Compare



Exercise output

Without expected output





Learning Procedures



Output



Exercise output



It's work!



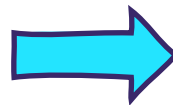
Learning Procedures



Output



Exercise output



It's work!



Is it work correctly?

01 Introduction

02

03

04

05

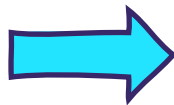


Learning Procedures

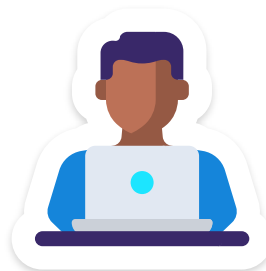
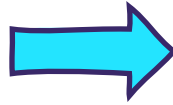
10



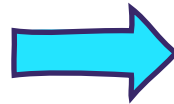
Novice Learners



Exercise



Coding



Testing

01 Introduction

02

03

04

05

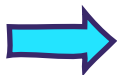


Learning Procedures

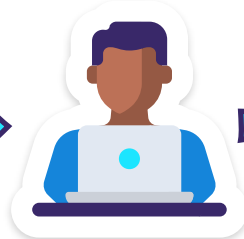
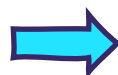
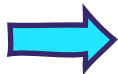
“Make **test** before making program”



Novice Learners



Exercise



Coding



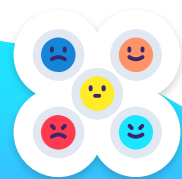
Testing

Test-first Approach



02

Test-first Approach





Test-driven development

13



Test-driven development (TDD)

01

02 Test-first Approach

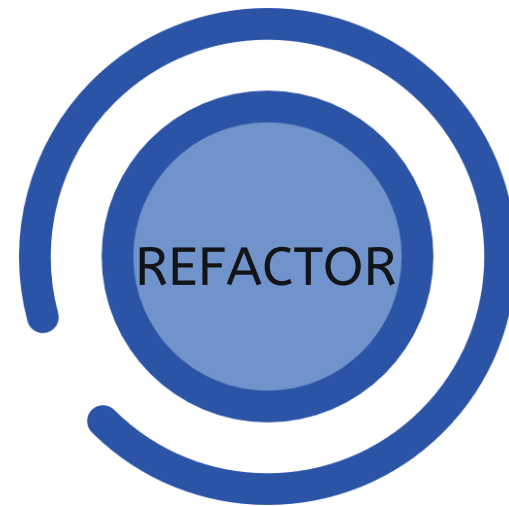
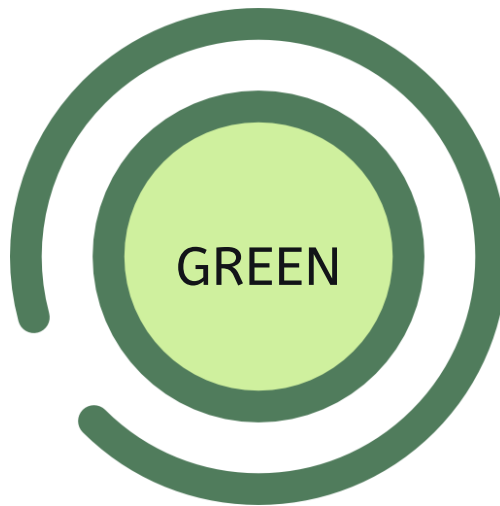
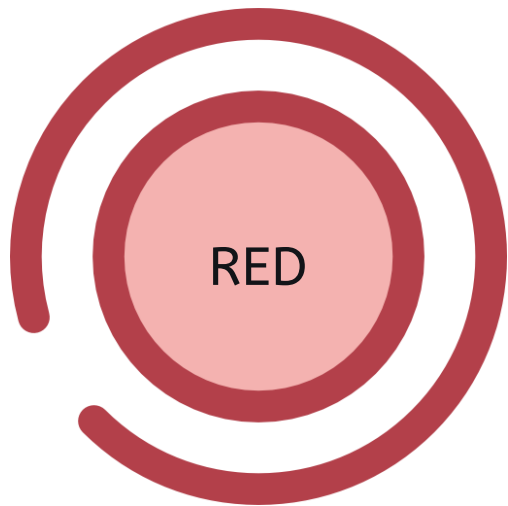
03

04

05



Test-driven development cycle





Test-driven development cycle

Make test cases





Test-driven development cycle

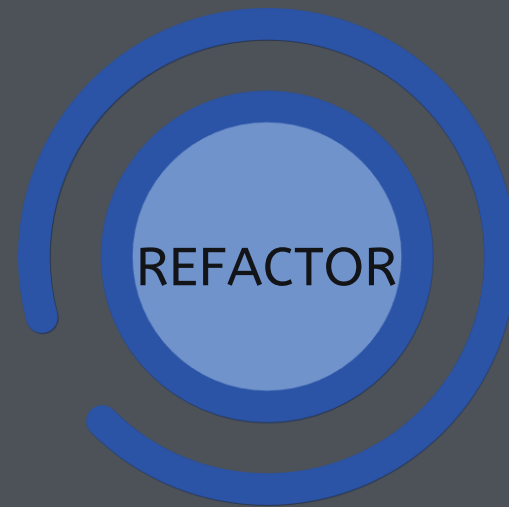
Write code to pass test cases





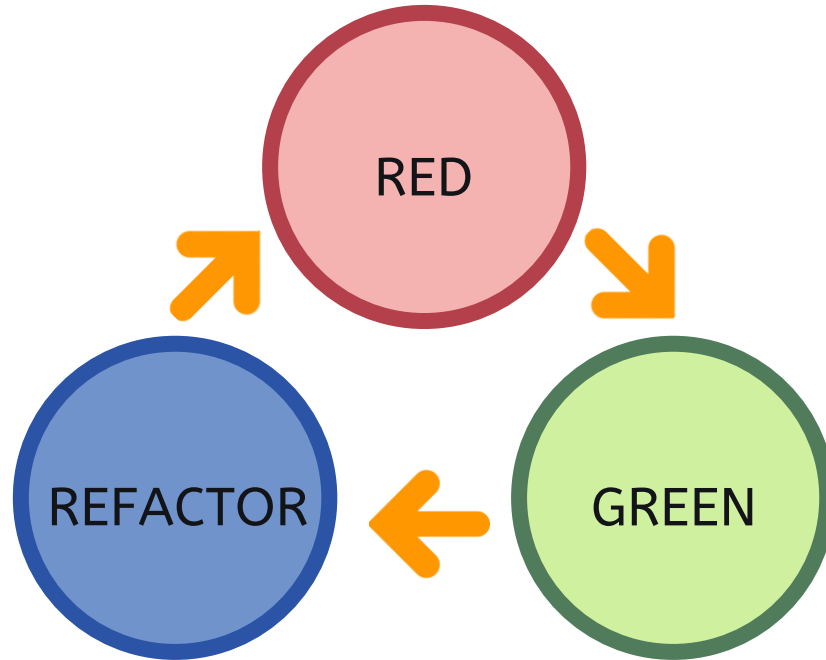
Test-driven development cycle

Maintaining code
and Re-testing



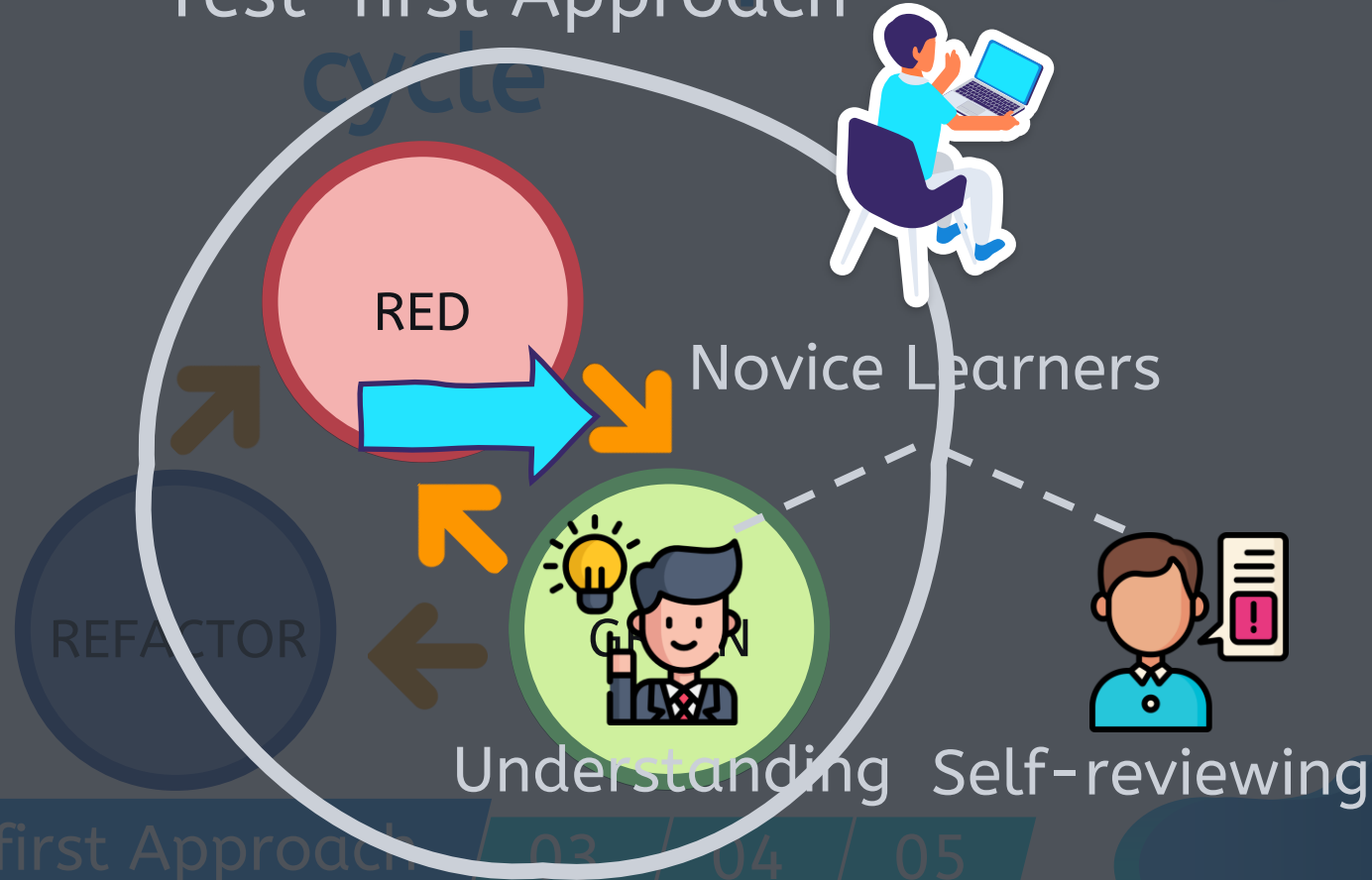


Test-driven development cycle



Test-driven development cycle

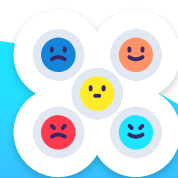
Test-first Approach





03

Methodology





Basic Programming Course

21



Tamagawa University
Tokyo, Japan

01

02

03 Methodology

04

05



Basic Programming Course

22



Tamagawa University
Tokyo, Japan

1. Lecture
2. Basic Exercises
3. Advanced Exercises

01

02

03 Methodology

04

05



Basic Programming Course

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Tamagawa University
Tokyo, Japan

1. Lecture

2. Basic Exercises

3. Advanced Exercises

1. Lecture



01

02

03 Methodology

04

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Basic Programming Course

24



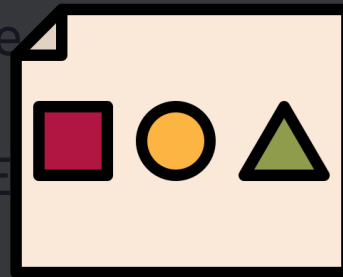
Tamagawa University
Tokyo, Japan

1. Lecture

2. Basic Exercises

3. Advanced Exercises

2. Basic Exercises



01

02

03 Methodology

04

05



Basic Programming Course

25



Tamagawa University
Tokyo, Japan

1. Lecture

2. Basic Exercises

3. Advanced Exercises

3. Advanced Exercises



01

02

03 Methodology

04

05



Basic Programming Course

26



Tamagawa University
Tokyo, Japan

1. Lecture
2. Basic Exercises
3. Advanced Exercises

01

02

03 Methodology

04

05



Basic Programming Course

27



Tamagawa University
Tokyo, Japan

1. Lecture + Explain test-first approach
2. Basic Exercises + Example test cases
3. Advanced Exercises + Make test cases

01

02

03 Methodology

04

05



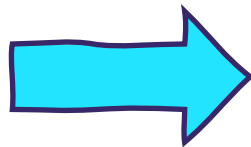
System Requirements



A System integrated with test-first approach.



System Requirements

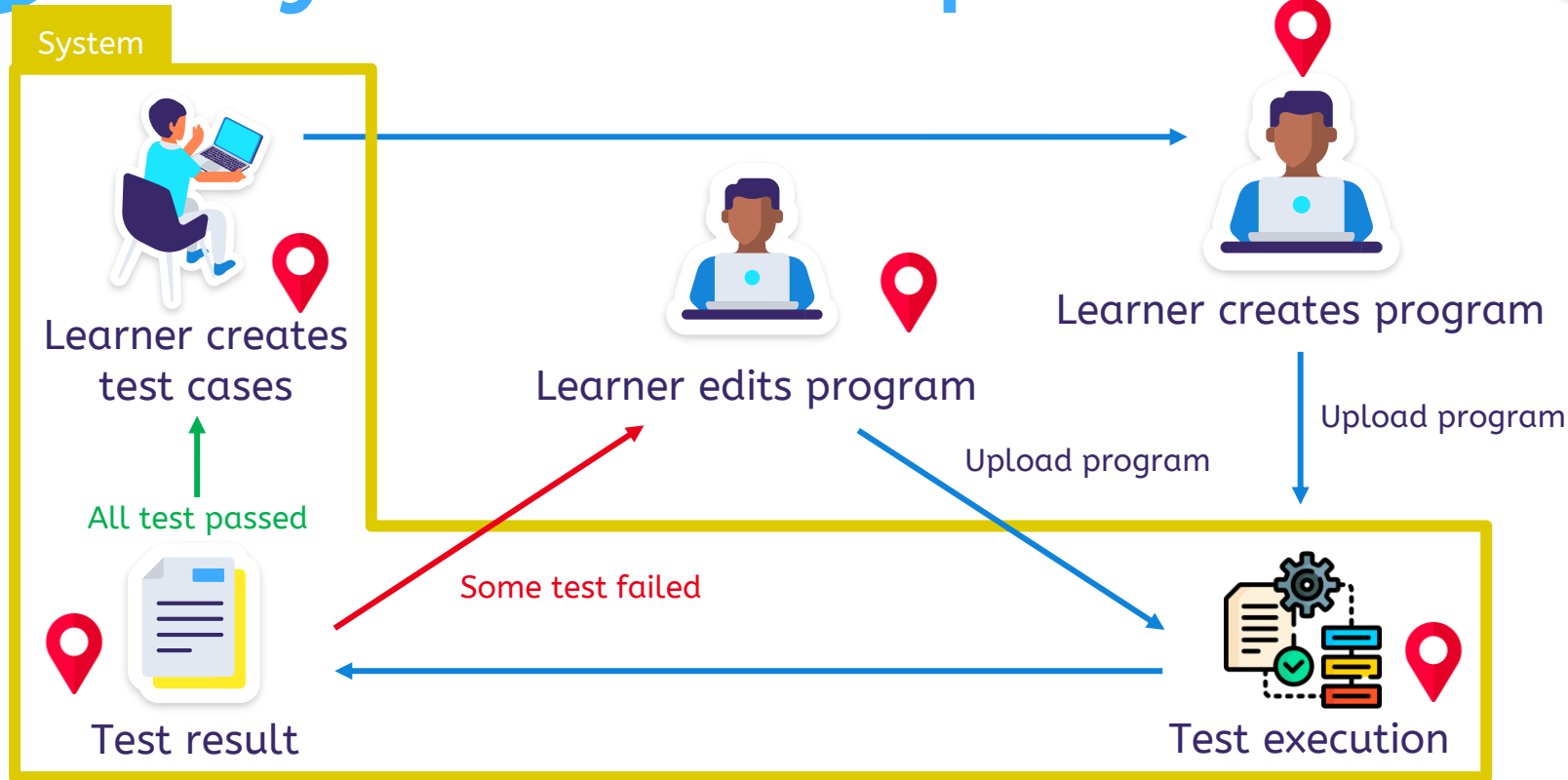


A System integrated
with **test-first approach**.

Students (**Novice Learners**)
Easy to make **test cases** and **run test**.



System Development





Experiment



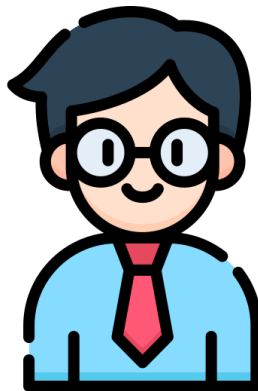
A System integrated with test-first approach.



Experiment



A System integrated
with **test-first approach**.



1 Teacher



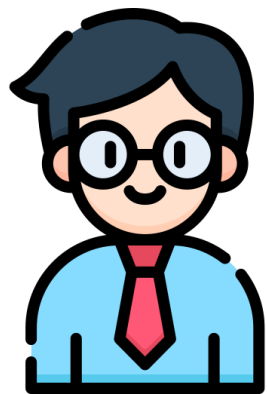
3 Students

Participants



Experiment Procedures

1. Programming without test-first approach



Teacher

Doing
→



Exercise

←
Doing



Students



Experiment Procedures

2. Explains test-first approach



Teacher



Researchers

Test-first Approach



Students

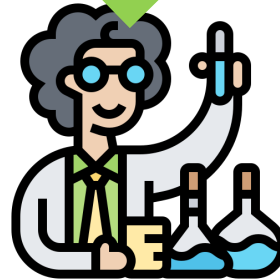


Experiment Procedures

3. Programming with test-first approach



Teacher



Researchers

A System integrated with **test-first approach**.

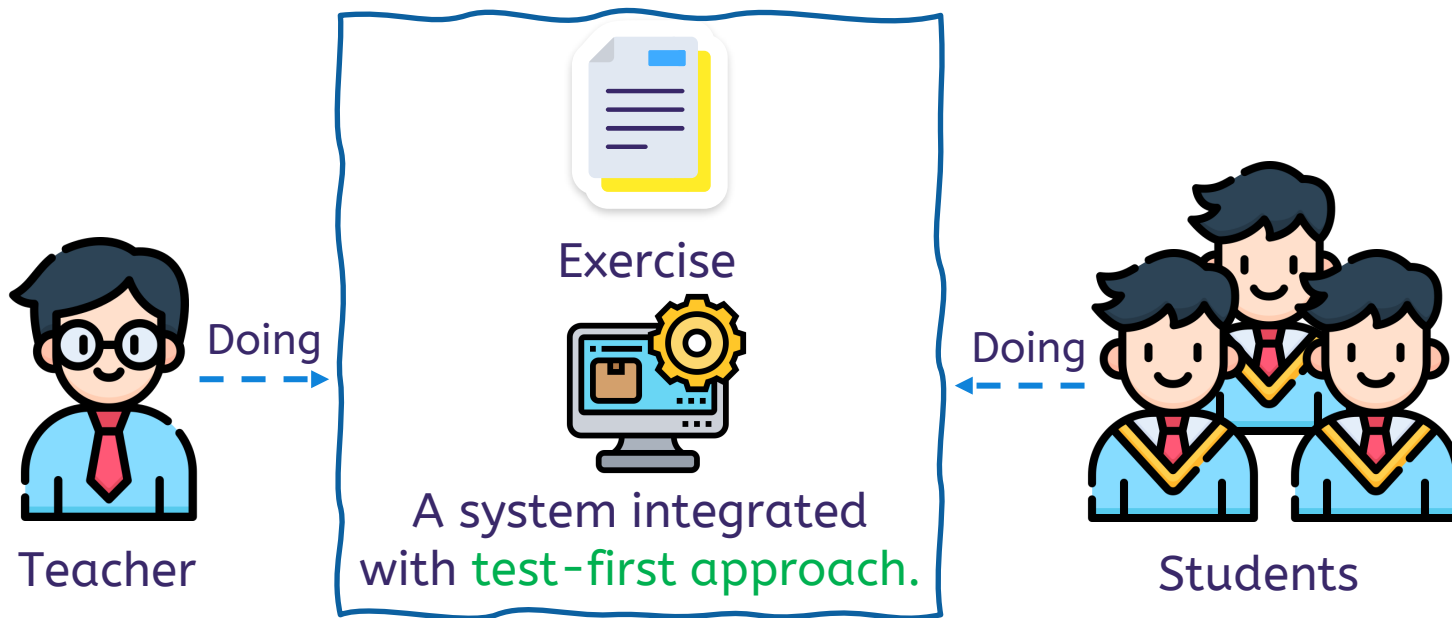


Students



Experiment Procedures

3. Programming with test-first approach





Experiment Procedures

4. Researchers gives an exercise scores



Researchers



Experiment Procedures

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4. Researchers gives an exercise scores

Scores without the system.



Exercise

Scores with the system.



Exercise

01

02






03 Methodology

04

05

Experiment Procedures

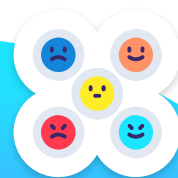
4. Re

Scores	Conditions
0	Program is incomplete. 
1	Program is complete. 
2	Program is complete and compiles with requirements. 
3	Program is complete and tested with test cases. 
4	Program is complete and tested with necessary test cases. 



04

Result and discussion





Experiment Results

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Scores without the system.

	P1	P2	P3	P4
Exercise scores	0	1	4	1

Scores with the system.

	P1	P2	P3	P4
Exercise scores	4	4	4	4

01

02

03

04 Result and discussion

05



05

Conclusion





Research Conclusion



Researchers

01

02

03

04

05 Conclusion



Research Conclusion



A system integrated with
test-first approach
is useful.



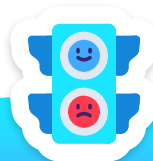
The **test-first approach**
gives learners
a self-reviewing.

References

[1] K. Suetake and T. Tanaka, "A Support System for Programming Exercises Using Test-first Approach," 2022 12th International Congress on Advanced Applied Informatics (IIAI-AAI), 2022, pp. 178–181, doi: 10.1109/IIAIAAI55812.2022.00044.

[2] Icon and Image. <https://www.flaticon.com/>

[3] Icon and Image. <https://icons8.com/>



Q&A

