# Assessment and Evaluation of Ethical Reasoning Skills

Kojiro Honda

Humanities and Social Science Program,

Kanazawa Institute of Technology
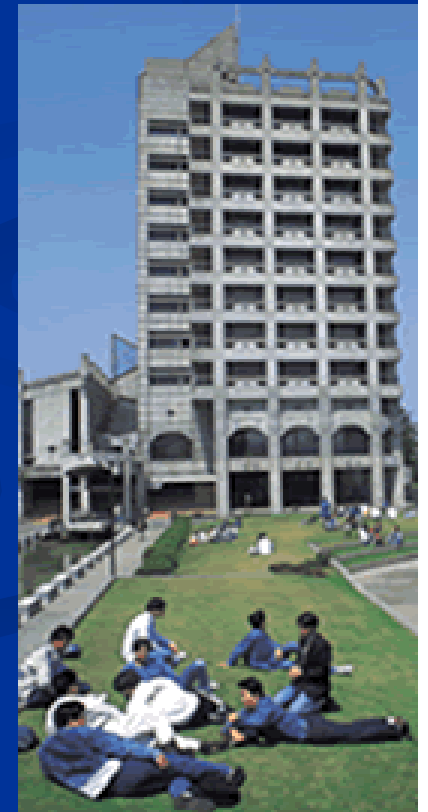
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2. Assessment
3. Result

# 1. Introduction

In this Presentation

- Our View of Assessment for Educational Effect of Case Method

- Our Practical Activities for Assessment

will be discussed.

# Case Method

- We use Case Method as core of our curriculum.
- We provide 3 cases for students' discussion as follows.

  1. Space Shuttle Challenger
  2. Research Ethics in Our University
  3. Gilbane Gold

# Case Method

- We expect that students can improve their competence such as

1. Analysis Skill
2. Explanation Skill
3. Question Skill
4. Skill to deal with Ethical Dilemma

# Case Method

- We call these skills "Ethical Reasoning Skills"
-  Can they be taught?

1. Analysis Skill
2. Explanation Skill
3. Question Skill
4. Skill to deal with Ethical Dilemma

# Theoretical Background

Five-Stage Skill-Acquisition Model

(by Hubert L. Dreyfus)

- Stage 1: Novice
- Stage 2: Advanced Beginner
- Stage 3: Competence
- Stage 4: Proficiency
- Stage 5: Expertise

- Stage 1: Novice

  The beginner is given rules for determining actions (…) much like a computer following a program.

- Stage 2: Advanced Beginner

- As novice gains experience actually coping with real situations, he or she begins to note (…) perspicuous examples of meaningful additional components of the situation.

- Stage 3: Competence

- With increasing experience, the number of features and aspects to be taken into account becomes overwhelming. (…) the performer learns to adopt a hierarchical view of decision making.

- Stage 4: Proficiency

- As soon as the competent performer stops reflecting on problematic situations as a detached observer and stops looking for principles to guide his or her actions, the gripping, holistic experiences from the competent stage become the basis of the next advance in skill.

- Stage 5: Expertise

- The proficient performer, immersed in the world of skillful activity, sees what needs to be done but must decide how to do it.

# Theoretical Background

- Case Method can't give a real experience.

- But it can provide good pseudo-experience for Dreyfus's Stage1 or 2.

- The skill-acquisition doesn't indicate moral development (cf. Kohlberg's theory) . We think students can improve their skills by training.

# C (Check)

- Assessing and estimating of students' ability to resolve the ethical dilemma in the engineering context

For what?

1 Measuring  what degree the students share the values to

2 Assessing the educational effect against students

3 Assessing how  the teachers keep their consistency of moral standards or moral opinions to estimate students ?

# C (Check)

So,

- Our assessment is teacher-oriented     and

- Our assessment is not concerned with students' grades.

# 2. Assessment

# Achievement Aim

- One of our achievement aim for students is

  "Can write short essay to prove your own analysis skill about ethical dilemma in a scenario"

# Assessment

## Method

- We gave the two scenarios at the beginning and the end of the semester.

<span style="color:yellow">Artificial Heart (at the beginning)</span>
<span style="color:yellow">Trees          (at the end)</span>

- Students should write essay about these scenarios with respect to ethical dilemma.

- We estimate their essays.

### *The Artificial Heart.*

- When Thomas Creighton, a 33-year old auto mechanic and divorced father of two rejected the heart he had received from an accident victim, he was put on the heart/lung machine. Dr. Jack Copeland and the transplant team at the University Medical Center in Tucson immediately began searching for another donor heart. So on Wednesday, 6 March 1985 at 6:00 a.m. Kevin Chaing of Phoenix received a call from cardiac surgeon, Dr. Copeland. When Copeland asked: is your heart ready to be implanted. Chaing thought the question referred to implanting the artificial heart he had invented into a calf. He and Dr. Copeland had done this experiment before and were planning to replicate it. When he learned that the intended recipient was a human being he balked. Wait a minute, that heart was designed for a calf it's not ready for a human yet. Think about it and decide said Copeland, I'll call you back in ten minutes.

- Questioned later Chaing said: I knelt and prayed. And when Dr. Copeland called him back he answered: the pump is sterile and ready to go. Meanwhile the donor heart that Dr. Copeland had requested from Utah had not yet arrived. By around noon the same day Mr. Creighton's physician decided that it would be dangerous to leave him on the heart/lung machine any longer. And so Dr. Copeland implanted the artificial heart device in Mr. Creighton. The artificial heart maintained Mr. Creighton's circulation until the donor heart arrived.

- At 11:00 p.m. that night the device was turned off and Mr. Creighton was put back on the heart/lung machine. At 3:00 a.m. on Thursday, Dr. Copeland transplanted the second donor heart. However, despite all efforts, Mr. Creighton died the following morning. The Phoenix artificial heart had nothing to do with causing his death. Nevertheless, in deciding to use the Phoenix heart Kevin Chaing and Dr. Copeland had apparently violated FDA regulations by employing a device that had not been approved for experimental use in humans. They justified their actions by claiming that their use of the device was an emergency measure. Chaing and Copeland had no intention of performing an experiment with Mr. Creighton. They were trying to save his life. The only other option was to let him die. We had nothing to lose by using the heart said Dr. Copeland.

## *Trees*

- Kevin Clearing is the engineering manager to the Verdant County Road Commission, which has primary responsibility for maintaining the safety of county roads. Verdant County's population has increased by 30 percent in the past ten years. This has resulted in increased traffic flow on many secondary roads in the area. Forest Drive, still a two-lane road, has more than doubled its traffic flow during this period. It is now one of the main arteries leading into Verdant City, an industrial and commercial center of more than 60,000 people.

- For each of the past seven years at least one person has suffered a fatal automobile accident by crashing into trees closely aligned along a three-mile stretch of Forest Drive. Many other accidents have also occurred, causing serious injuries, wrecked cars, and damaged trees. Some of the trees are quite close to the pavement. Two lawsuits have been filed against the road commission for not maintaining sufficient road safety along this three-mile stretch. Both were dismissed because the drivers were going well in excess of the 45 mph speed limit.

- Other members of VCRC have been pressing Kevin Clearing to come up with a solution to the traffic problem on Forest Drive. They are concerned about safety, as well as lawsuits that may some day go against VCRC. Clearing now has a plan—widen the road. Unfortunately, this will require cutting down about thirty healthy, long-standing trees along the road.

- Clearing's plan is accepted by VCRC and announced to the public. Immediately a citizen environmental group forms and registers a protest. Pat Northington, spokesperson for the group, complains, "These accidents are the fault of careless drivers. Cutting down trees to protect drivers from their own carelessness symbolizes the destruction of our natural environment for the sake of human 'progress.' It's time to turn things around. Sue the drivers if they don't drive sensibly. Let's preserve the natural beauty and ecological integrity around us while we can."

- Many letters on both sides of the issue appear in the Verdant Press, the issue is heatedly discussed on local TV, and Pat Northington presents VCRC with a petition to save the trees signed by 150 local citizens.

# Assessment

## Problems

- How do we assess their skills Quantitatively?

- How do we assess their skills Objectively?

# Assessment

## The Pittsburgh-Mines (P-M) Engineering Ethics Assessment Rubric

By  Larry J. Shuman et al.

- The method for assessment of students' ability to resolve ethical dilemma.

- They identified five components with five levels of achievement.

# Assessment

## The Pittsburgh-Mines (P-M) Engineering Ethics Assessment Rubric

① *Recognition of Dilemma*

② *Information*

③ *Analysis*

④ *Perspective*

⑤ *Resolution*

Cf.) Larry J. Shuman, Mark F. Sindelar, Mary Besterfield-Sacre, Harvey Wolf and Rosa L. Pinkus (2004) "Can Our Students Recognize and Resolve Ethical Dilemmas?", Proceeding of the 2004 ASEE Annual Conference & Expositon

# Assessment

- We tried PM rubric, but We felt we should make our own rubric.

- We needed easier and more speedy assessment.

- We should have established our educational policy by doing so.

# KIT Simple Rubric Ver.1
## (See Material 1)

KIT Simple Rubric Ver.1

| | | |
|---|---|---|
| 1 | **Perception of Problem** <br> Can identify the ethical problem | |
| 2 | **Stakeholder** <br> Can identify stakeholders | |
| 3 | **Situation** <br> Can recognize the relevant factors | |
| 4 | **Resolution** <br> Can make plural resolutions | |
| 5 | **Deliberation** <br> Can consider the results of the resolutions <br> and can choose the most effective one | |

Can't=0
Can=1
Excellently=3

# KIT Simple Rubric Ver.2

## KIT Simple Rubric Ver.2

| Attribute | Contents |
|---|---|
| 1 | Recognition | Can they recognize the ethical problem ? |

| Point | | |
|---|---|---|
| 0 | | Can't |
| 1 | | Can |
| 3 | | Excellently |

| 2 | Stakeholder | Can they identify stakeholders ? |

| Point | | |
|---|---|---|
| 0 | | Can't |
| 1 | | Can |
| 3 | | Excellently |

| 3 | Situation | Can they understand the situation accurately ? |

| Point | | |
|---|---|---|
| 0 | | Can't |
| 1 | | Can |
| 3 | | Excellently |

| 4 | Resolution | Can they show plural resolutions ? |

| Point | | |
|---|---|---|
| 0 | | Can't |
| 1 | | Can (more than 3) |
| 3 | | Excellently |

| 5 | Deliberation | Can they decide their own resolution with logical deliberation ? |

| Point | | |
|---|---|---|
| 0 | | Can't |
| 1 | | Can |
| 3 | | Excellently |

Score _____

※ Warning:
Mark the paper mainly with 0 or 1. Give "excellently" only if you think that everyone can estimate it to be excellent.

# KIT Simple Rubric Ver.3

科学技術者倫理　自由記述問題　採点基準

| | 評価項目 | | 評価内容 | |
|---|---|---|---|---|
| ① | 倫理問題認識 | | 倫理的問題を認識することができているか。 | ① |
| | （プラス表現力） | 3点 | 例外的に優れた回答。 | |
| | | 2点 | 認識したうえで、それを的確に表現することができている。 | |
| | | 1点 | 認識できている。 | |
| | | 0点 | 認識できていない。 | 点 |
| ② | 関係者認識 | | 利害関係者を認識できているか。 | ② |
| | | 3点 | 例外的に優れた回答。 | |
| | | 2点 | シナリオ内のみならず、シナリオ外の重要な利害関係者を認識することが出来ている。 | |
| | | 1点 | シナリオに登場する利害関係者を全て認識することができる。 | |
| | | 0点 | 認識できていない。 | 点 |
| ③ | 事実認識 | | 事実関係を十分に認識できているか。 | ③ |
| | | 3点 | 例外的に優れた回答。 | |
| | | 2点 | 認識できているだけでなく、欠けている情報や未知の情報についても考察できている。 | |
| | | 1点 | 認識できている。 | |
| | | 0点 | 認識できていない。 | 点 |
| ④ | 当事者感覚 | | 当該の倫理的問題に関して、主人公がその行為を選んだ理由を理解できているか。 | ④ |
| | （プラス表現力） | 3点 | 例外的に優れた回答。 | |
| | | 2点 | 理解したうえで、それを的確に表現することができている。 | |
| | | 1点 | 理解できている。 | |
| | | 0点 | 理解できていない。 | 点 |
| ⑤ | 視点の多様性 | | 利害関係者それぞれの視点から、多角的に状況を見ることができているか。 | ⑤ |
| | | 3点 | 例外的に優れた回答。 | |
| | | 2点 | 重要な利害関係者だけでなく、さらに多くの視点から状況を見ることができている。 | |
| | | 1点 | 重要な利害関係者それぞれの視点から、状況を見ることができている。 | |
| | | 0点 | 一つの視点からしか状況を見ていない。 | 点 |
| ⑥ | 解決策の決定 | | 複数の解決案を提案し、比較検討した上で解決策を決定することができているか。 | ⑥ |
| | （プラス分析力） | 3点 | 例外的に優れた回答。 | |
| | | 2点 | それぞれの解決案の妥当性を十分比較検討した上で、解決策を決定することができている。 | |
| | | 1点 | 解決案を複数提案できているが、検討が不十分。 | |
| | | 0点 | 解決案を複数提案できていない。 | 点 |

# KIT Simple Rubric Ver.5

KIT Simple Rubric Ver.5

出来ていない＝×
出来ている＝○
特に優れている＝◎

| | 測定項目 | | 内容 | | スコア |
|---|---|---|---|---|---|
| | 事実認識 | 1 | 重要な事実関係を把握できているか. | | |
| | | 2 | ケースに明示されている事実関係を正確に表現できているか. | | |
| | | 3 | ケースに明示されていないが事実関係についても洞察できているか. | | |
| | | | | | |
| | 問題認識 | 1 | 倫理的問題の焦点の所在を理解できているか. | | |
| | | 2 | 当該の倫理的問題を明確に表現できているか. | | |
| | | | | | |
| | 関係者 | 1 | ケースに明示されている重要な利害関係者を列挙できているか. | | |
| | | 2 | ケースに明示されている利害関係者を全て列挙できているか. | | |
| | | 3 | ケースに直接明示されていない利害関係者を特定できているか. | | |
| | | | | | |
| | 解決案 | 1 | 具体的な解決案を少なくとも一つ提示できているか. | | |
| | | 2 | 複数の具体的な解決案を提示できているか. | | |
| | | 3 | 独創的な解決案を提示することができているか. | | |
| | | | | | |

# KIT Simple Rubric Ver.7

KIT Simple Rubric Ver.7

Rater's Name

Yes, he/she can = 1
No, he/she can't = 0

| Attribute | | | Score |
|---|---|---|---|
| A) Perception of Problem | 1 | Can he/she identify ethical problems in the case ? | |
| | 2 | Can he/she identify the problems appropriately ? | |

☆If he/she can't make a score at A-1, you need not continue to rate the following.

| Attribute | | | Score |
|---|---|---|---|
| B) Recognition of Facts | 1 | Can he/she recognize the minimum facts for considering the case ? | |
| | 2 | Can he/she recognize the explicit facts in the case ? | |
| | 3 | Can he/she recognize the implicit facts in the case, too ? | |
| C) Recognition of Stakeholders | 1 | Can he/she recognize the minimum stakeholders for considering the case ? | |
| | 2 | Can he/she recognize almost all the explicit stakeholders in the case ? | |
| | 3 | Can he/she recognize the implicit stakeholders in the case, too ? | |
| D) Resolution | 1 | Can he/she show at least one resolution which is operable ? | |
| | 2 | Can he/she show plural resolutions which are operable ? | |
| | 3 | Can he/she make the win-win situation in at least one resolution ? | |

# KIT Simple Rubric Ver.7(Continued)

| E) Ethical Reasoning | 1 | Can he/she do ethical reasoning in at least one resolution ? | |
|---|---|---|---|
| | 2 | Can he/she do ethical reasoning in plural resolutions ? | |
| | 3 | Can he/she choose the most effective one from among plural resolutions ? | |

| F) Perspective | 1 | Can he/she consider the problem from different perspectives of stakeholders ? | |
|---|---|---|---|

(☆ For Future Reference)

| G) Commitment | 1 | Can he/she commit himself/herself to the problem as a insider ? | |
|---|---|---|---|

| H) Expressivity | 1 | Can he/she write his/her essay with felicity ? | |
|---|---|---|---|
| | 2 | Can he/she explain himself/herself appropriately with premised knowledge ? | |

Class _____      Student's Name _____

# KIT Simple Rubric Ver.7

- We have 6 components

  A) Perception of Problem
  B) Recognition of Facts
  C) Recognition of Stakeholders
  D) Resolution
  E) Ethical Reasoning
  F) Perspective

# KIT Simple Rubric Ver.7

- We adopt 2 points scale (0 or 1)
- Students are estimated by the total score.



- For easy rating.
- For easy checking the difference among teachers.

# Inter-Rater Reliability

- We should estimate objectivity of our assessment for

  1. Quantitative Assessment
  2. Guarantee Our Consistency of Educational Policy (Peer Estimation)

# Inter-Rater Reliability

<u>5 Teachers did</u>

1. Read and estimate same 10 students' essays
2. Estimate gaps of estimation among the 5
3. Reduce  the gaps by discussion
4. Make a consistent policy of estimation among the 5.

# Difference of Rating Result among 5 Teachers (Artificial Heart)

A-1 Can he/she identify ethical problems in the case ?

|     | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 |
|-----|----|----|----|----|----|----|----|----|----|-----|
| T1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 1   |
| T2  | 1  | 1  | 0  | 1  | 0  | 0  | 1  | 0  | 1  | 0   |
| T3  | 1  | 1  | 0  | 1  | 0  | 1  | 1  | 0  | 1  | 0   |
| T4  | 1  | 0  | 1  | 1  | 0  | 0  | 1  | 1  | 0  | 0   |
| T5  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1   |

A-2 Can he/she identify the problems appropriately ?

|     | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 |
|-----|----|----|----|----|----|----|----|----|----|-----|
| T1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0   |
| T2  | 1  | 1  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0   |
| T3  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
| T4  | 1  | 0  | 0  | 1  | 0  | 0  | 1  | 0  | 0  | 0   |
| T5  | 1  | 1  | 0  | 1  | 0  | 0  | 1  | 0  | 1  | 0   |

# Difference of Rating Result among 5 Teachers (Trees)

A-1  Can he/she identify ethical problems in the case ?

|    | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 |
|----|----|----|----|----|----|----|----|----|----|-----|
| T1 | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1   |
| T2 | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 1  | 0   |
| T3 | 1  | 1  | 1  | 1  | 0  | 1  | 0  | 0  | 1  | 0   |
| T4 | 1  | 1  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 1   |
| T5 | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1   |

A-2  Can he/she identify the problems appropriately ?

|    | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 |
|----|----|----|----|----|----|----|----|----|----|-----|
| T1 | 1  | 1  | 1  | 1  | 0  | 1  | 1  | 0  | 1  | 0   |
| T2 | 1  | 0  | 1  | 1  | 0  | 0  | 0  | 0  | 1  | 0   |
| T3 | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
| T4 | 1  | 0  | 1  | 0  | 0  | 0  | 1  | 0  | 1  | 0   |
| T5 | 1  | 0  | 1  | 0  | 0  | 1  | 0  | 0  | 1  | 0   |

# Difference of Rating Result among 5 Teachers (Ideal Result)

A-1　Can he/she identify ethical problems in the case ?

|     | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 |
| --- | -- | -- | -- | -- | -- | -- | -- | -- | -- | --- |
| T1  | 1  | 0  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 0   |
| T2  | 1  | 0  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 0   |
| T3  | 1  | 0  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 0   |
| T4  | 1  | 0  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 0   |
| T5  | 1  | 0  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 0   |

A-2　Can he/she identify the problems appropriately ?

|     | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 |
| --- | -- | -- | -- | -- | -- | -- | -- | -- | -- | --- |
| T1  | 1  | 0  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 0   |
| T2  | 1  | 0  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 0   |
| T3  | 1  | 0  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 0   |
| T4  | 1  | 0  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 0   |
| T5  | 1  | 0  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 0   |

# Intra Crass Correlation (ICC)



Attached in
SPSS

# Inter-Rater Reliability

## Artificial Heart

|      | S1A | S2A | S3A | S4A | S5A | S6A | S7A | S8A | S9A | S10A |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| T1   | 7   | 4   | 5   | 6   | 3   | 4   | 3   | 3   | 4   | 6    |
| T2   | 7   | 0   | 0   | 4   | 3   | 2   | 0   | 0   | 0   | 2    |
| T3   | 7   | 3   | 5   | 7   | 6   | 2   | 4   | 3   | 3   | 5    |
| T4   | 7   | 0   | 3   | 7   | 5   | 3   | 0   | 4   | 0   | 4    |
| T5   | 11  | 0   | 0   | 7   | 0   | 4   | 5   | 0   | 2   | 0    |

ICC=0.861（Cronbach's $\alpha$）

# Inter-Rater Reliability

## Trees

|     | S1B | S2B | S3B | S4B | S5B | S6B | S7B | S8B | S9B | S10B |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| T1  | 8   | 0   | 7   | 7   | 6   | 0   | 0   | 2   | 4   | 11   |
| T2  | 4   | 0   | 5   | 5   | 6   | 0   | 0   | 0   | 0   | 7    |
| T3  | 5   | 3   | 8   | 7   | 7   | 3   | 2   | 4   | 6   | 9    |
| T4  | 6   | 0   | 9   | 7   | 8   | 2   | 0   | 4   | 5   | 10   |
| T5  | 8   | 5   | 10  | 12  | 12  | 0   | 3   | 8   | 7   | 11   |

ICC=0．963 （Cronbach's $\alpha$）

# 3. Result

# Change of Average Total Scores during the Semester (1)

クラス別平均点の推移（標本数各10）
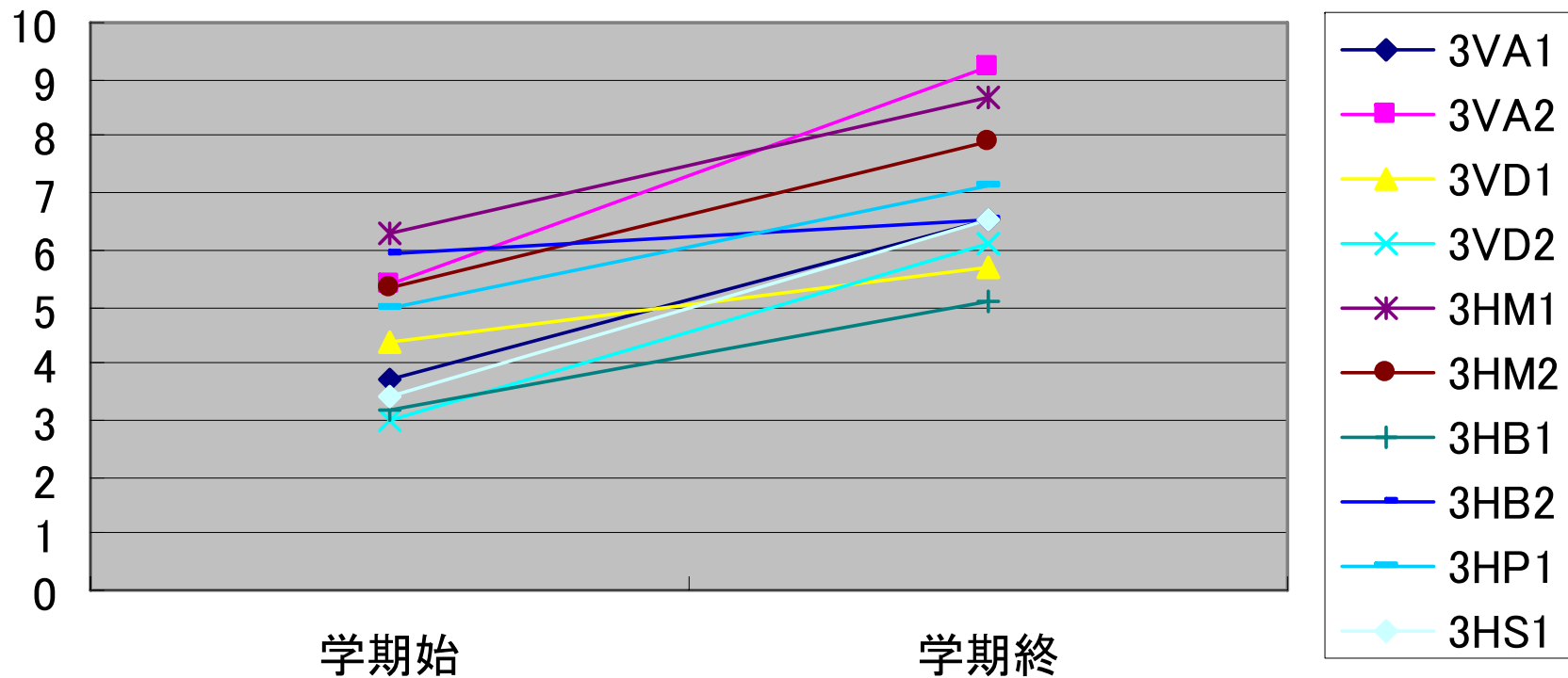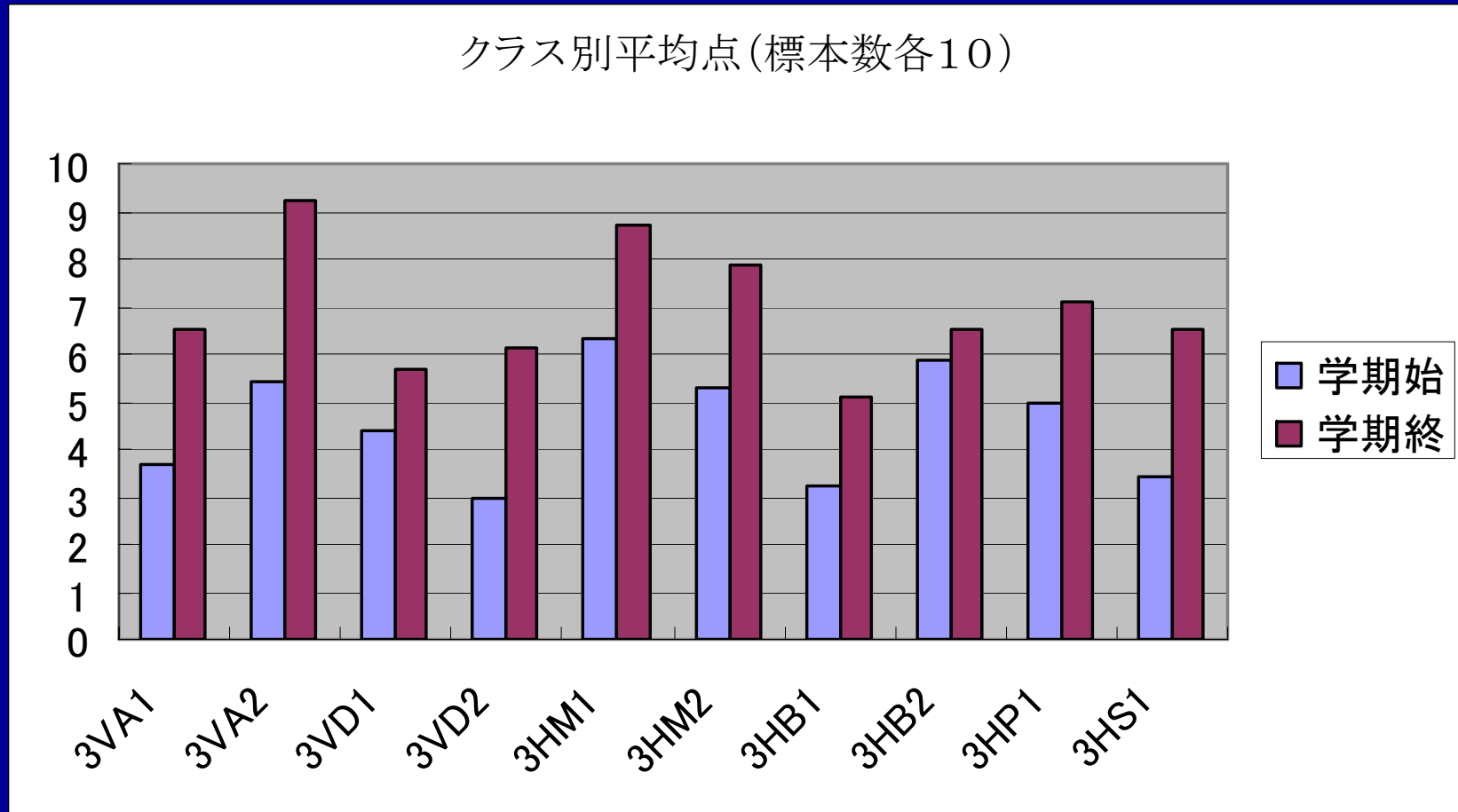


Legend:
- 3VA1
- 3VA2
- 3VD1
- 3VD2
- 3HM1
- 3HM2
- 3HB1
- 3HB2
- 3HP1
- 3HS1

X-axis: 学期始　　学期終

# Change of Average Total Scores during the Semester (2)



クラス別平均点（標本数各10）

Legend: 学期始 (light blue), 学期終 (dark red)

Categories: 3VA1, 3VA2, 3VD1, 3VD2, 3HM1, 3HM2, 3HB1, 3HB2, 3HP1, 3HS1

2007 Spring

# Change of Average Total Scores during the Semester (3)



総合平均点の推移（標本数１００）

Legend: Total

Axis labels: 学期始　学期終
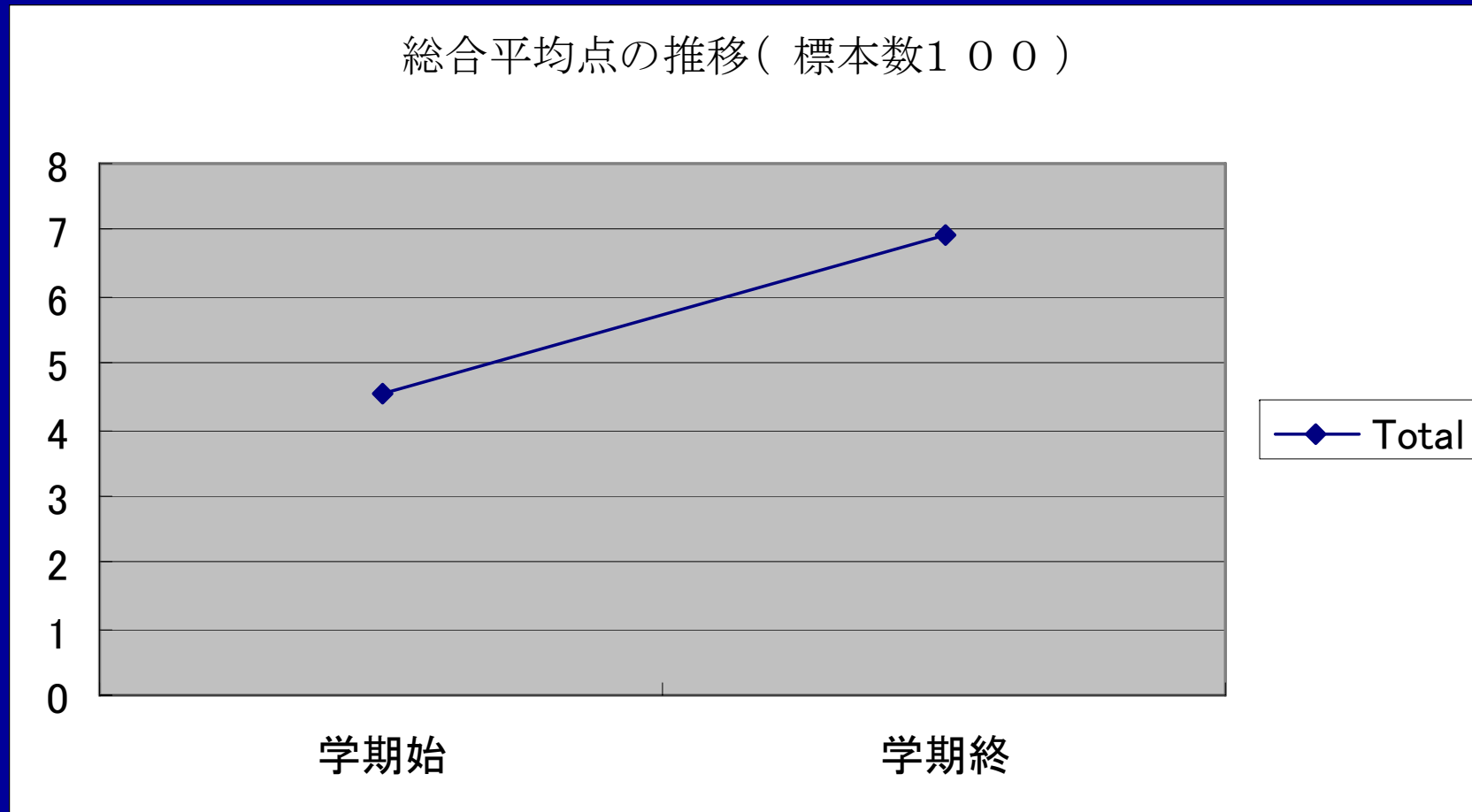
# Change of Average Total Scores during the Semester

- We can indicate 2 points

1. All classes increase their total score

2. We have various growth rates of the score among the classes

# Review

We did

1. Make our own simple rubric,
2. Make a method to share the educational policy by checking ICC (Peer Estimation),
3. Make a method for quantitative assessment of students' ethical reasoning skills.

The change of average scores indicated that

Students could increase their skills in the semester

# Challenge

- We have something to discuss as follows,

1. What does it mean, the difference of score among the classes?

2. What does it mean, the difference of growth rate among the classes? Does it depend of Teachers' competence?

Etc.

# Thank you for your attention!

## E-mail:

### k-honda@neptune.kanazawa-it.ac.jp