喬色園主辦 可觀自然教育中心暨天文館

Ho Koon Nature Education cum Astronomical Centre (Sponsored by Sik Sik Yuen)

饒 戈

YIU Vor

Instructional field study 導 向 式 野 外 研 習

Procedure

Instructional field study 導 向 式 野 外 研 習

Procedure

➡teacher arranges equipment, prepare worksheets...

Instructional field study 導 向 式 野 外 研 習

Procedure

➡teacher arranges equipment, prepare worksheets...

➡(students preview worksheets)

Instructional field study 導 向 式 野 外 研 習

Procedure

➡teacher arranges equipment, prepare worksheets...

➡(students preview worksheets)

➡teacher briefs students

Instructional field study 導 向 式 野 外 研 習

Procedure

➡teacher arranges equipment, prepare worksheets...

➡(students preview worksheets)

➡teacher briefs students

➡field work

Instructional field study 導 向 式 野 外 研 習

Procedure

➡teacher arranges equipment, prepare worksheets...

➡(students preview worksheets)

➡teacher briefs students

➡field work

➡(laboratory work)

Instructional field study 導 向 式 野 外 研 習

Procedure

➡teacher arranges equipment, prepare worksheets...

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➡teacher briefs students

➡field work

➡(laboratory work)

➡data analysis, prepare oral report

Instructional field study 導 向 式 野 外 研 習

Procedure

➡teacher arranges equipment, prepare worksheets...

➡(students preview worksheets)

➡teacher briefs students

➡field work

➡(laboratory work)

➡data analysis, prepare oral report

➡oral report/presentation

Instructional field study 導向式野外研習

Procedure

➡teacher arranges equipment, prepare worksheets...

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➡teacher briefs students

➡field work

➡(laboratory work)

➡data analysis, prepare oral report

➡oral report/presentation

➡prepare written report

Investigatory field study 探 究 式 野 外 研 习

Procedure

Investigatory field study 探 究 式 野 外 研 習

Procedure

➡students prepare investigation proposal, teacher facilitates/ encourages/assists/guides

Investigatory field study 探 究 式 野 外 研 习

Procedure

➡students prepare investigation proposal, teacher facilitates/ encourages/assists/guides

➡students present/share their proposals

Investigatory field study 探 究 式 野 外 研 习

Procedure

➡students prepare investigation proposal, teacher facilitates/ encourages/assists/guides

➡students present/share their proposals

➡teacher gives feedbacks, students amend/adjust proposals

Investigatory field study 探 究 式 野 外 研 习

Procedure

➡students prepare investigation proposal, teacher facilitates/ encourages/assists/guides

➡students present/share their proposals

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Investigatory field study 探 究 式 野 外 研 习

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➡(laboratory work)

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➡(laboratory work)

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➡field work

➡(laboratory work)

➡data analysis, prepare oral report

➡oral report/presentation

➡prepare written report

Investigatory field study 探 究 式 野 外 研 习

2 Modes

Investigatory field study 探 究 式 野 外 研 习

2 Modes

1. Students decide topic and design procedures

Investigatory field study 探 究 式 野 外 研 习

2 Modes

1. Students decide topic and design procedures

2. Teacher provide topic(s), student design procedures

Establishing investigation topics

Establishing investigation topics

More relevant knowledge and concepts

Establishing investigation topics

More relevant knowledge and concepts

- Diversity of life forms

Establishing investigation topics

More relevant knowledge and concepts

- Diversity of life forms
- Different ways through which organisms adapt to their habitats

Establishing investigation topics

More relevant knowledge and concepts

- Diversity of life forms
- Different ways through which organisms adapt to their habitats
- Classification of organisms

Establishing investigation topics

More relevant knowledge and concepts

- Diversity of life forms
- Different ways through which organisms adapt to their habitats
- Classification of organisms
- Dichotomous key

Establishing investigation topics

More relevant knowledge and concepts

- Diversity of life forms
- Different ways through which organisms adapt to their habitats
- Classification of organisms
- Dichotomous key
- Level of organization - species, population, community...

Establishing investigation topics

More relevant knowledge and concepts

- Diversity of life forms
- Different ways through which organisms adapt to their habitats
- Classification of organisms
- Dichotomous key
- Level of organization - species, population, community...
- Abiotic factors

Establishing investigation topics

More relevant knowledge and concepts

- Diversity of life forms
- Different ways through which organisms adapt to their habitats
- Classification of organisms
- Dichotomous key
- Level of organization - species, population, community...
- Abiotic factors
- Niche and habitat

Establishing investigation topics

More relevant knowledge and concepts

- Diversity of life forms
- Different ways through which organisms adapt to their habitats
- Classification of organisms
- Dichotomous key
- Level of organization - species, population, community...
- Abiotic factors
- Niche and habitat
- Species diversity and dominant species.

Establishing investigation topics

More relevant knowledge and concepts

- Diversity of life forms
- Different ways through which organisms adapt to their habitats
- Classification of organisms
- Dichotomous key
- Level of organization - species, population, community...
- Abiotic factors
- Niche and habitat
- Species diversity and dominant species.
- Relationships between organisms - predation, competition,...

Establishing investigation topics

More relevant knowledge and concepts

- Diversity of life forms
- Different ways through which organisms adapt to their habitats
- Classification of organisms
- Dichotomous key
- Level of organization - species, population, community...
- Abiotic factors
- Niche and habitat
- Species diversity and dominant species.
- Relationships between organisms - predation, competition,...
- Energy flow and relationships of organisms - food web, pyramids of number...

Establishing investigation topics

More relevant knowledge and concepts

- Diversity of life forms
- Different ways through which organisms adapt to their habitats
- Classification of organisms
- Dichotomous key
- Level of organization - species, population, community...
- Abiotic factors
- Niche and habitat
- Species diversity and dominant species.
- Relationships between organisms - predation, competition,...
- Energy flow and relationships of organisms - food web, pyramids of number...
- Cycling of material in an ecosystem

Establishing investigation topics

More relevant knowledge and concepts

- Diversity of life forms
- Different ways through which organisms adapt to their habitats
- Classification of organisms
- Dichotomous key
- Level of organization - species, population, community...
- Abiotic factors
- Niche and habitat
- Species diversity and dominant species.
- Relationships between organisms - predation, competition,...
- Energy flow and relationships of organisms - food web, pyramids of number...
- Cycling of material in an ecosystem
- Human activities and conservation

Establishing investigation topics

More relevant knowledge and concepts

- Diversity of life forms
- Different ways through which organisms adapt to their habitats
- Classification of organisms
- Dichotomous key
- Level of organization - species, population, community...
- Abiotic factors
- Niche and habitat
- Species diversity and dominant species.
- Relationships between organisms - predation, competition,...
- Energy flow and relationships of organisms - food web, pyramids of number...
- Cycling of material in an ecosystem
- Human activities and conservation
- Distribution and abundance of organisms

Establishing investigation topics

More relevant knowledge and concepts

- Diversity of life forms
- Different ways through which organisms adapt to their habitats
- Classification of organisms
- Dichotomous key
- Level of organization - species, population, community...
- Abiotic factors
- Niche and habitat
- Species diversity and dominant species.
- Relationships between organisms - predation, competition,...
- Energy flow and relationships of organisms - food web, pyramids of number...
- Cycling of material in an ecosystem
- Human activities and conservation
- Distribution and abundance of organisms
- Measurement of abiotic factors

Establishing investigation topics

Establishing investigation topics

Relevant knowledge and concepts ?

Establishing investigation topics

Relevant knowledge and concepts ?

- Which fish is fastest?

Establishing investigation topics

Relevant knowledge and concepts ?

- Which fish is fastest?
- Which snail shell is hardest?

Establishing investigation topics

Relevant knowledge and concepts ?

- Which fish is fastest?
- Which snail shell is hardest?
- Recording the trail of 1-hour movement of a Large Stream Snail

Establishing investigation topics

Relevant knowledge and concepts ?

- Which fish is fastest?
- Which snail shell is hardest?
- Recording the trail of 1-hour movement of a Large Stream Snail
- Stream animals attracted to a piece of bread

Establishing investigation topics

Relevant knowledge and concepts ?

- Which fish is fastest?
- Which snail shell is hardest?
- Recording the trail of 1-hour movement of a Large Stream Snail
- Stream animals attracted to a piece of bread
- Variation of size of rocks along the stream

Establishing investigation topics

Relevant knowledge and concepts ?

- Which fish is fastest?
- Which snail shell is hardest?
- Recording the trail of 1-hour movement of a Large Stream Snail
- Stream animals attracted to a piece of bread
- Variation of size of rocks along the stream

Establishing investigation topics

Establishing investigation topics

Out of students' knowledge and ability?

Establishing investigation topics

Out of students' knowledge and ability?

- Measuring biodiversity index of different streams

Establishing investigation topics

Out of students' knowledge and ability?

- Measuring biodiversity index of different streams
- About the species composition of the mosses in Tai Tso Stream

Establishing investigation topics

Out of students' knowledge and ability?

- Measuring biodiversity index of different streams
- About the species composition of the mosses in Tai Tso Stream
- A taxonomical review of the Hong Kong Caddisflies (Trichoptera)

Establishing investigation topics

Out of students' knowledge and ability?

- Measuring biodiversity index of different streams
- About the species composition of the mosses in Tai Tso Stream
- A taxonomical review of the Hong Kong Caddisflies (Trichoptera)
- A study of the toxicity of Methyl Tertiary Butyl Ether (MTBE) to freshwater organisms

Establishing investigation topics

Out of students' knowledge and ability?

- Measuring biodiversity index of different streams
- About the species composition of the mosses in Tai Tso Stream
- A taxonomical review of the Hong Kong Caddisflies (Trichoptera)
- A study of the toxicity of Methyl Tertiary Butyl Ether (MTBE) to freshwater organisms
- A morphological comparison of the alimentary canal of 10 different species of mayfly nymphs

Establishing investigation topics

Out of students' knowledge and ability?

- Measuring biodiversity index of different streams
- About the species composition of the mosses in Tai Tso Stream
- A taxonomical review of the Hong Kong Caddisflies (Trichoptera)
- A study of the toxicity of Methyl Tertiary Butyl Ether (MTBE) to freshwater organisms
- A morphological comparison of the alimentary canal of 10 different species of mayfly nymphs

Establishing investigation topics

Establishing investigation topics

Availability of subject(s) being investigated

Establishing investigation topics

Availability of subject(s) being investigated

- Study of rare stream animals

Establishing investigation topics

Availability of subject(s) being investigated

- Study of rare stream animals
- Study of mutualism in the stream animal community

Establishing investigation topics

Availability of subject(s) being investigated

- Study of rare stream animals
- Study of mutualism in the stream animal community
- Study of the life history of Hong Kong Newt

Establishing investigation topics

Availability of subject(s) being investigated

- Study of rare stream animals
- Study of mutualism in the stream animal community
- Study of the life history of Hong Kong Newt

Establishing investigation topics

Establishing investigation topics

Little chance of success?

Establishing investigation topics

Little chance of success?

- Effect of water temperature variation to the animal community in a pool

Establishing investigation topics

Little chance of success?

- Effect of water temperature variation to the animal community in a pool
- How does air humidity affect the behaviour of a stream loach

Establishing investigation topics

Little chance of success?

- Effect of water temperature variation to the animal community in a pool
- How does air humidity affect the behaviour of a stream loach
- Who is the predator of Large Stream Snail

Establishing investigation topics

Little chance of success?

- Effect of water temperature variation to the animal community in a pool
- How does air humidity affect the behaviour of a stream loach
- Who is the predator of Large Stream Snail
- A study of the evolution of aquatic insects in Hong Kong

Establishing investigation topics

Little chance of success?

- Effect of water temperature variation to the animal community in a pool
- How does air humidity affect the behaviour of a stream loach
- Who is the predator of Large Stream Snail
- A study of the evolution of aquatic insects in Hong Kong

Establishing investigation topics

Establishing investigation topics

Some possible topics

Establishing investigation topics

Some possible topics

- Biodiverstiy in the upper stream

Establishing investigation topics

Some possible topics

- Biodiverstiy in the upper stream
- How do the stream organisms adapt to the impacts of water flow

Establishing investigation topics

Some possible topics

- Biodiverstiy in the upper stream
- How do the stream organisms adapt to the impacts of water flow
- Water flow rate and distribution of stream animals

Establishing investigation topics

Some possible topics

- Biodiverstiy in the upper stream
- How do the stream organisms adapt to the impacts of water flow
- Water flow rate and distribution of stream animals
- How does light intensity affect distribution of animals and plants

Establishing investigation topics

Some possible topics

- Biodiverstiy in the upper stream
- How do the stream organisms adapt to the impacts of water flow
- Water flow rate and distribution of stream animals
- How does light intensity affect distribution of animals and plants
- Would light intensity affect density of freshwater plants?

Establishing investigation topics

Some possible topics

- Biodiverstiy in the upper stream
- How do the stream organisms adapt to the impacts of water flow
- Water flow rate and distribution of stream animals
- How does light intensity affect distribution of animals and plants
- Would light intensity affect density of freshwater plants?
- A study of dominant species in the freshwater stream ecosystem

Establishing investigation topics

Some possible topics

- Biodiverstiy in the upper stream
- How do the stream organisms adapt to the impacts of water flow
- Water flow rate and distribution of stream animals
- How does light intensity affect distribution of animals and plants
- Would light intensity affect density of freshwater plants?
- A study of dominant species in the freshwater stream ecosystem
- Comparison of benthic fishes

Establishing investigation topics

Some possible topics

- Biodiverstiy in the upper stream
- How do the stream organisms adapt to the impacts of water flow
- Water flow rate and distribution of stream animals
- How does light intensity affect distribution of animals and plants
- Would light intensity affect density of freshwater plants?
- A study of dominant species in the freshwater stream ecosystem
- Comparison of benthic fishes
- A study of the 3 stream snails

Establishing investigation topics

Some possible topics

- Biodiverstiy in the upper stream
- How do the stream organisms adapt to the impacts of water flow
- Water flow rate and distribution of stream animals
- How does light intensity affect distribution of animals and plants
- Would light intensity affect density of freshwater plants?
- A study of dominant species in the freshwater stream ecosystem
- Comparison of benthic fishes
- A study of the 3 stream snails
- Comparison of external features of benthic fishes and non-benthic fishes

Establishing investigation topics

Some possible topics

- Biodiverstiy in the upper stream
- How do the stream organisms adapt to the impacts of water flow
- Water flow rate and distribution of stream animals
- How does light intensity affect distribution of animals and plants
- Would light intensity affect density of freshwater plants?
- A study of dominant species in the freshwater stream ecosystem
- Comparison of benthic fishes
- A study of the 3 stream snails
- Comparison of external features of benthic fishes and non-benthic fishes
- Influence of domestic sewage on stream ecosystem

Establishing investigation topics

Establishing investigation topics

Some possible topics

Establishing investigation topics

Some possible topics

- Animal community in the polluted water

Establishing investigation topics

Some possible topics

- Animal community in the polluted water
- Nature of substrate and the animal community

Establishing investigation topics

Some possible topics

- Animal community in the polluted water
- Nature of substrate and the animal community
- Energy flow and the feeding relationships in a stream ecosystem

Establishing investigation topics

Some possible topics

- Animal community in the polluted water
- Nature of substrate and the animal community
- Energy flow and the feeding relationships in a stream ecosystem
- How does gaseous exchange of the animals be facilitated in the water?

Establishing investigation topics

Some possible topics

- Animal community in the polluted water
- Nature of substrate and the animal community
- Energy flow and the feeding relationships in a stream ecosystem
- How does gaseous exchange of the animals be facilitated in the water?
- Cryptic colouration of the stream animals

Establishing investigation topics

Some possible topics

- Animal community in the polluted water
- Nature of substrate and the animal community
- Energy flow and the feeding relationships in a stream ecosystem
- How does gaseous exchange of the animals be facilitated in the water?
- Cryptic colouration of the stream animals
- Influence of stream plants on stream animals

Establishing investigation topics

Some possible topics

- Animal community in the polluted water
- Nature of substrate and the animal community
- Energy flow and the feeding relationships in a stream ecosystem
- How does gaseous exchange of the animals be facilitated in the water?
- Cryptic colouration of the stream animals
- Influence of stream plants on stream animals
- Diversity of micro-organisms in the stream ecosystem

Establishing investigation topics

Some possible topics

- Animal community in the polluted water
- Nature of substrate and the animal community
- Energy flow and the feeding relationships in a stream ecosystem
- How does gaseous exchange of the animals be facilitated in the water?
- Cryptic colouration of the stream animals
- Influence of stream plants on stream animals
- Diversity of micro-organisms in the stream ecosystem
- Distribution and diversity of mosses and liverworts in the stream habitat

Establishing investigation topics

Some possible topics

- Animal community in the polluted water
- Nature of substrate and the animal community
- Energy flow and the feeding relationships in a stream ecosystem
- How does gaseous exchange of the animals be facilitated in the water?
- Cryptic colouration of the stream animals
- Influence of stream plants on stream animals
- Diversity of micro-organisms in the stream ecosystem
- Distribution and diversity of mosses and liverworts in the stream habitat
- Why mayfly nymphs are most abundant in a stream?

Establishing investigation topics

Some possible topics

- Animal community in the polluted water
- Nature of substrate and the animal community
- Energy flow and the feeding relationships in a stream ecosystem
- How does gaseous exchange of the animals be facilitated in the water?
- Cryptic colouration of the stream animals
- Influence of stream plants on stream animals
- Diversity of micro-organisms in the stream ecosystem
- Distribution and diversity of mosses and liverworts in the stream habitat
- Why mayfly nymphs are most abundant in a stream?
- Various protective cases of caddisfly larvae

Establishing investigation topics

Establishing investigation topics

Some possible topics

Establishing investigation topics

Some possible topics

- The water skater

Establishing investigation topics

Some possible topics

- The water skater
- Morphological features of the predators in a stream ecosystem

Establishing investigation topics

Some possible topics

- The water skater
- Morphological features of the predators in a stream ecosystem
- How do animals protect themselves from predators?

Establishing investigation topics

Some possible topics

- The water skater
- Morphological features of the predators in a stream ecosystem
- How do animals protect themselves from predators?
- Influence of the exotic plant - *Mikania micrantha* to the stream ecosystem

Establishing investigation topics

Some possible topics

- The water skater
- Morphological features of the predators in a stream ecosystem
- How do animals protect themselves from predators?
- Influence of the exotic plant - *Mikania micrantha* to the stream ecosystem
- Variety of gills of the aquatic insect larvae/nymphs

Establishing investigation topics

Some possible topics

- The water skater
- Morphological features of the predators in a stream ecosystem
- How do animals protect themselves from predators?
- Influence of the exotic plant - *Mikania micrantha* to the stream ecosystem
- Variety of gills of the aquatic insect larvae/nymphs
- Diversity of niches of stream animals

Establishing investigation topics

Some possible topics

- The water skater
- Morphological features of the predators in a stream ecosystem
- How do animals protect themselves from predators?
- Influence of the exotic plant - *Mikania micrantha* to the stream ecosystem
- Variety of gills of the aquatic insect larvae/nymphs
- Diversity of niches of stream animals
- Animal and plant community of a concrete channel

Establishing investigation topics

Some possible topics

- The water skater
- Morphological features of the predators in a stream ecosystem
- How do animals protect themselves from predators?
- Influence of the exotic plant - *Mikania micrantha* to the stream ecosystem
- Variety of gills of the aquatic insect larvae/nymphs
- Diversity of niches of stream animals
- Animal and plant community of a concrete channel
- A comparison of Long-armed Shrimp and Bee Shrimp

Establishing investigation topics

Some possible topics

- The water skater
- Morphological features of the predators in a stream ecosystem
- How do animals protect themselves from predators?
- Influence of the exotic plant - *Mikania micrantha* to the stream ecosystem
- Variety of gills of the aquatic insect larvae/nymphs
- Diversity of niches of stream animals
- Animal and plant community of a concrete channel
- A comparison of Long-armed Shrimp and Bee Shrimp
- A comparison of a stream site without plant and a stream site with plants

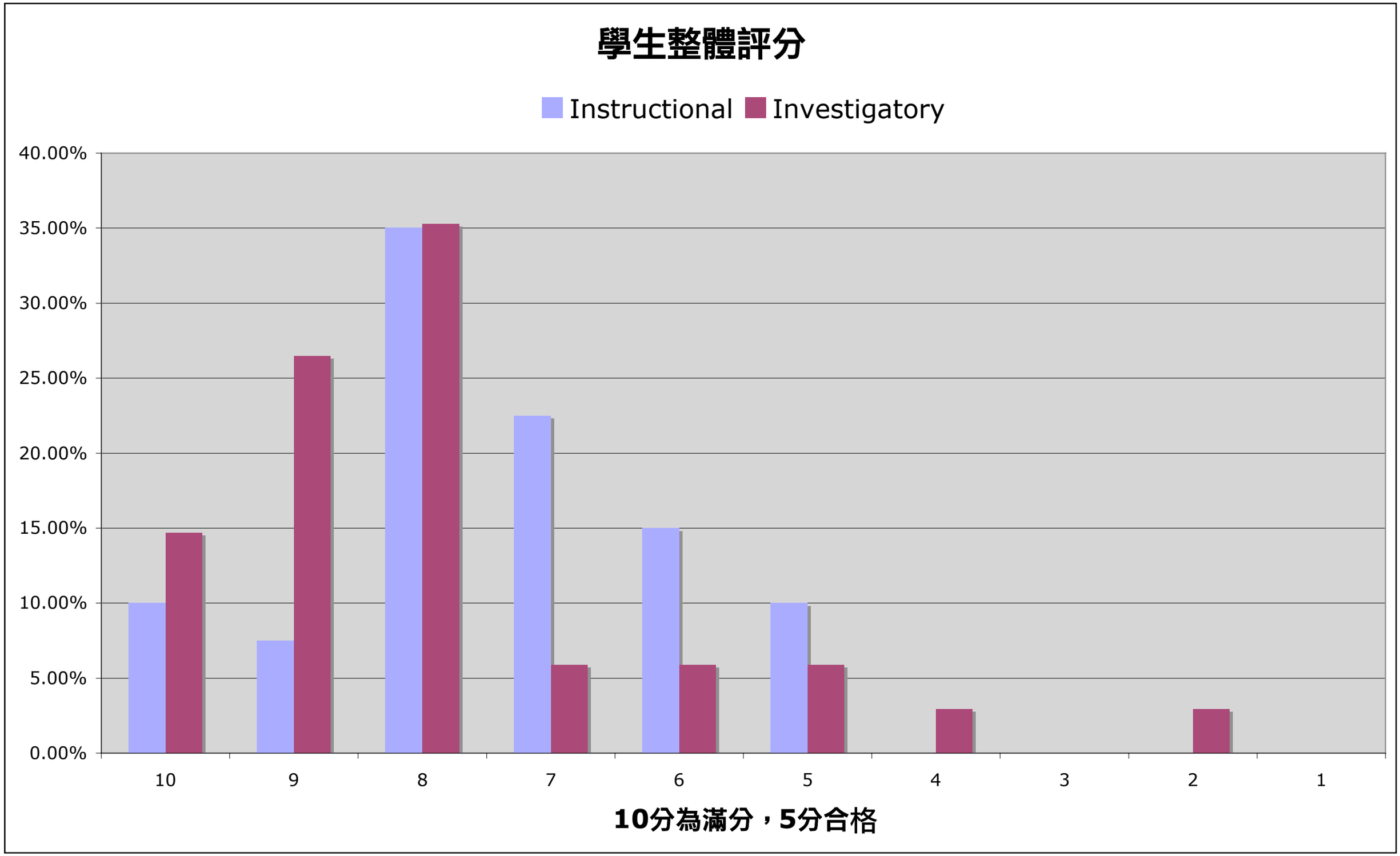
Establishing investigation topics

Some possible topics

- The water skater
- Morphological features of the predators in a stream ecosystem
- How do animals protect themselves from predators?
- Influence of the exotic plant - *Mikania micrantha* to the stream ecosystem
- Variety of gills of the aquatic insect larvae/nymphs
- Diversity of niches of stream animals
- Animal and plant community of a concrete channel
- A comparison of Long-armed Shrimp and Bee Shrimp
- A comparison of a stream site without plant and a stream site with plants
- Animal community under rocks in the bottom of a stream

Instructional field study vs Investigatory field study

導向式野外研習　　探究式野外研習



Instructional field study vs Investigatory field study

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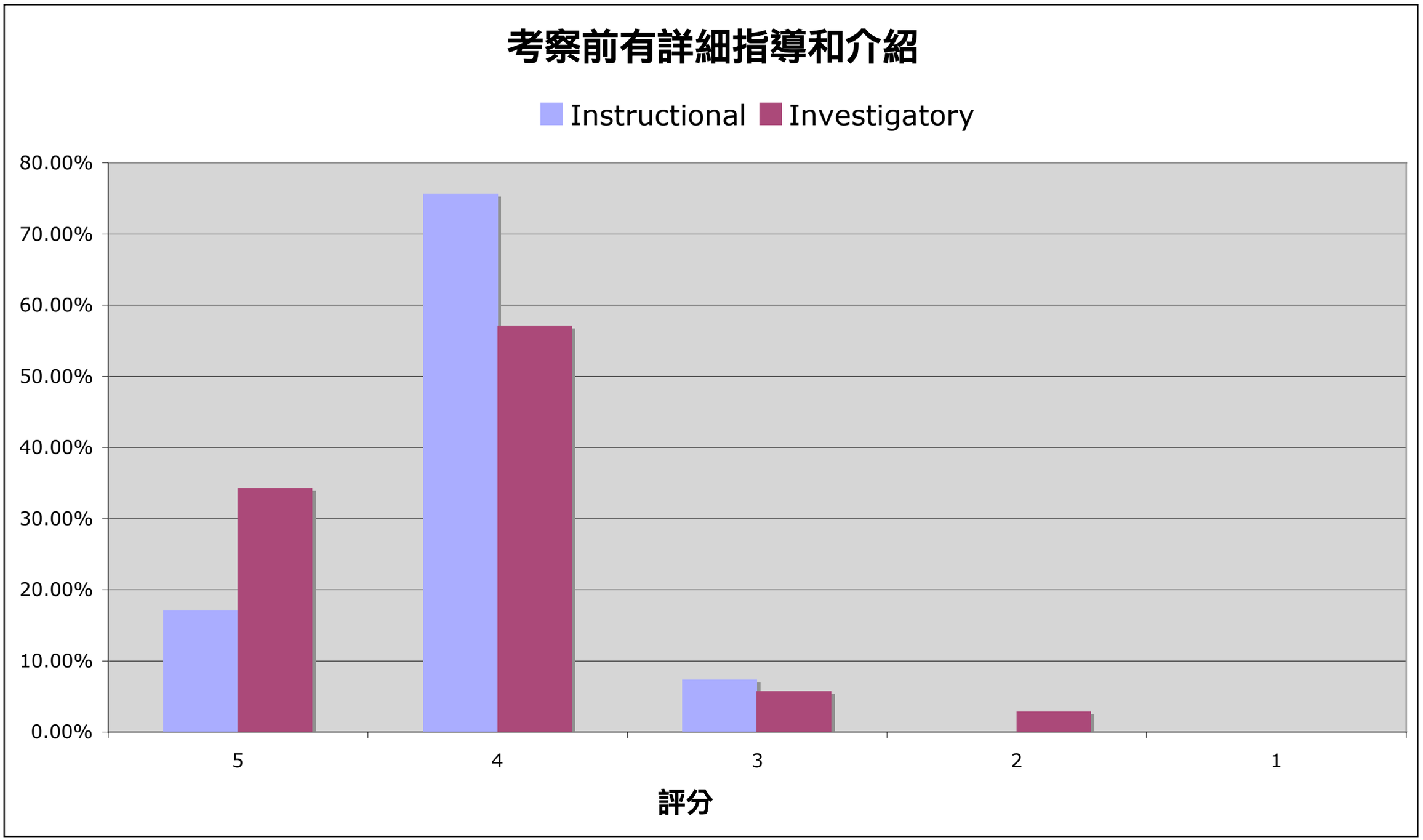

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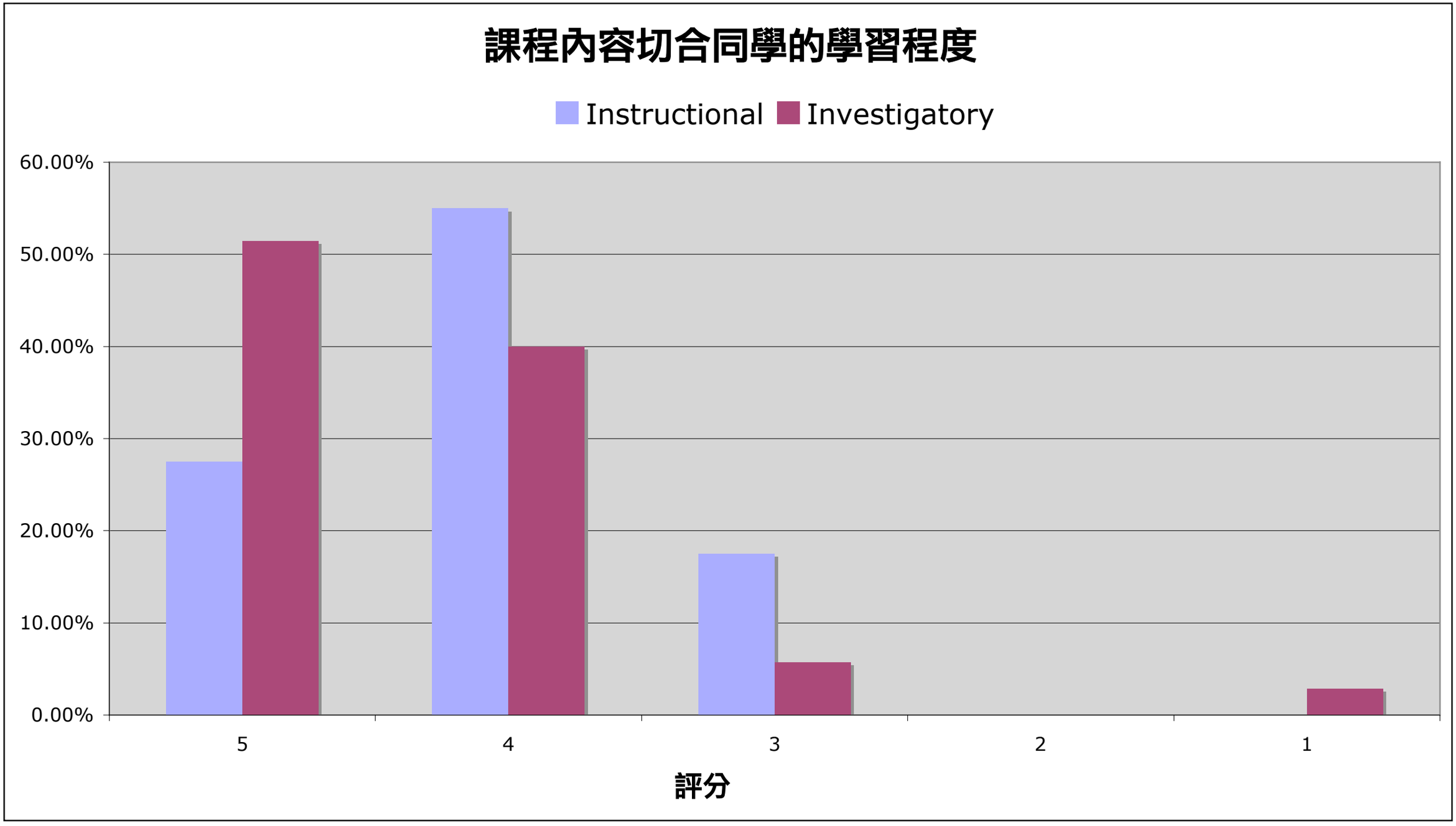

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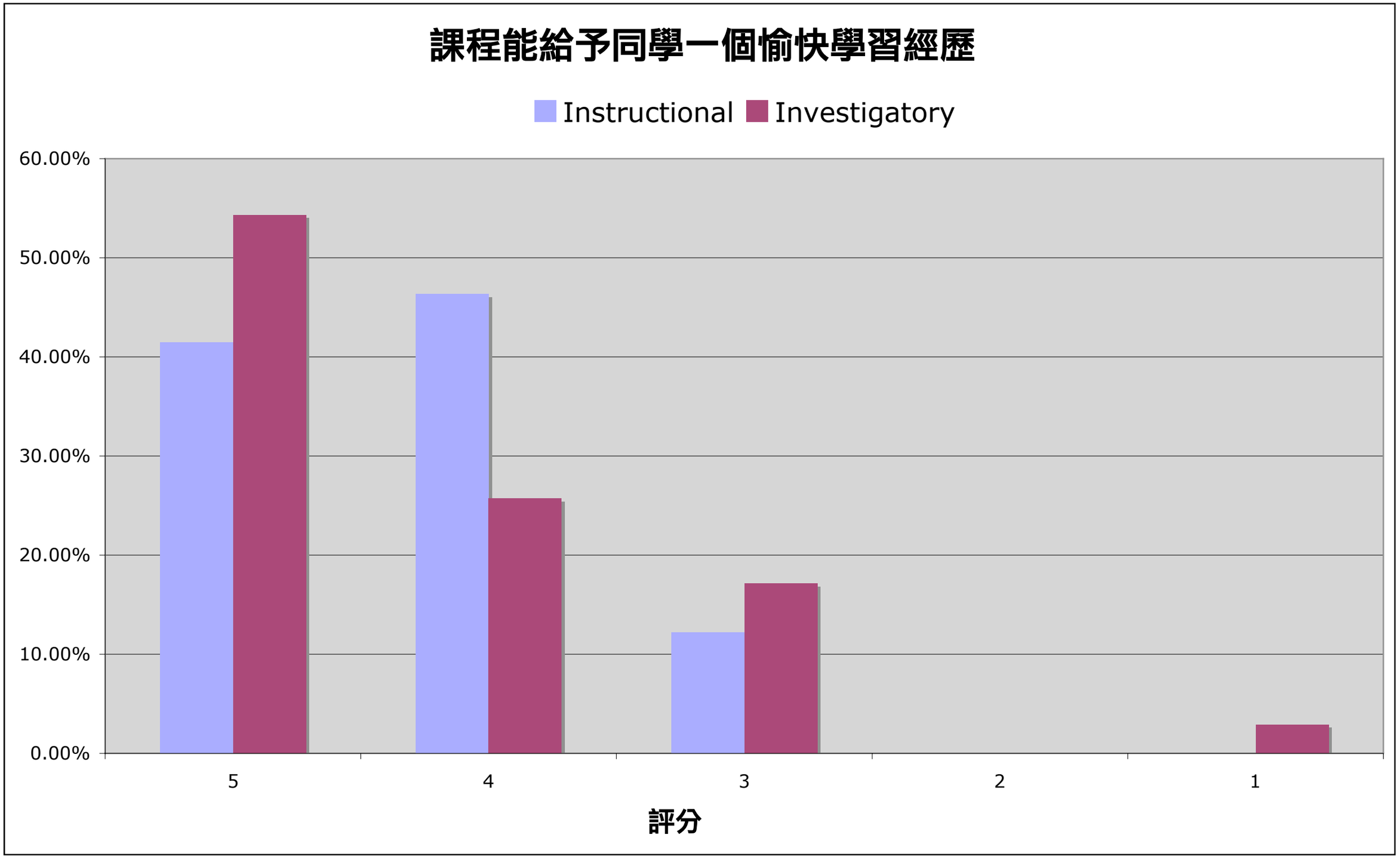

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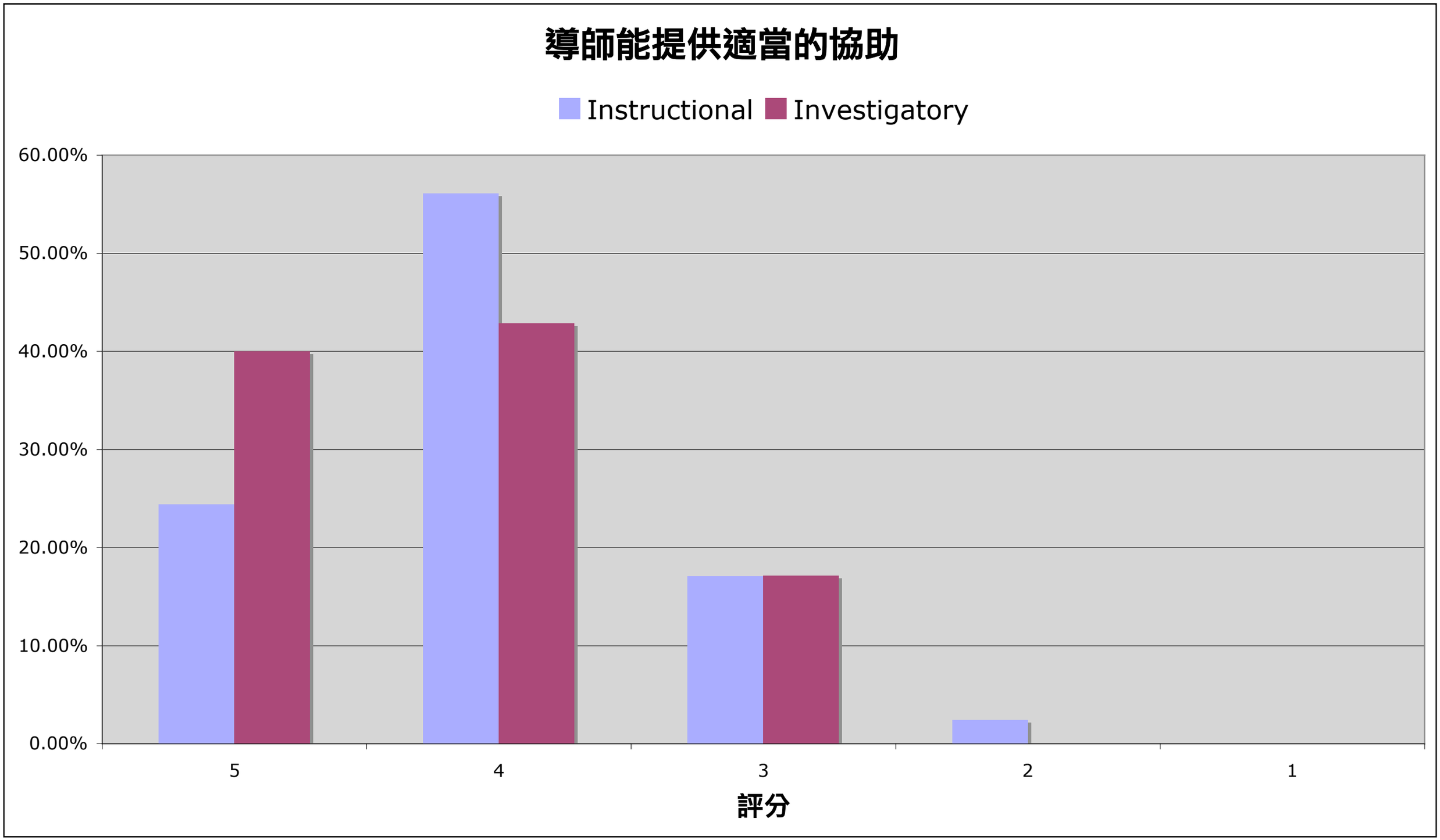

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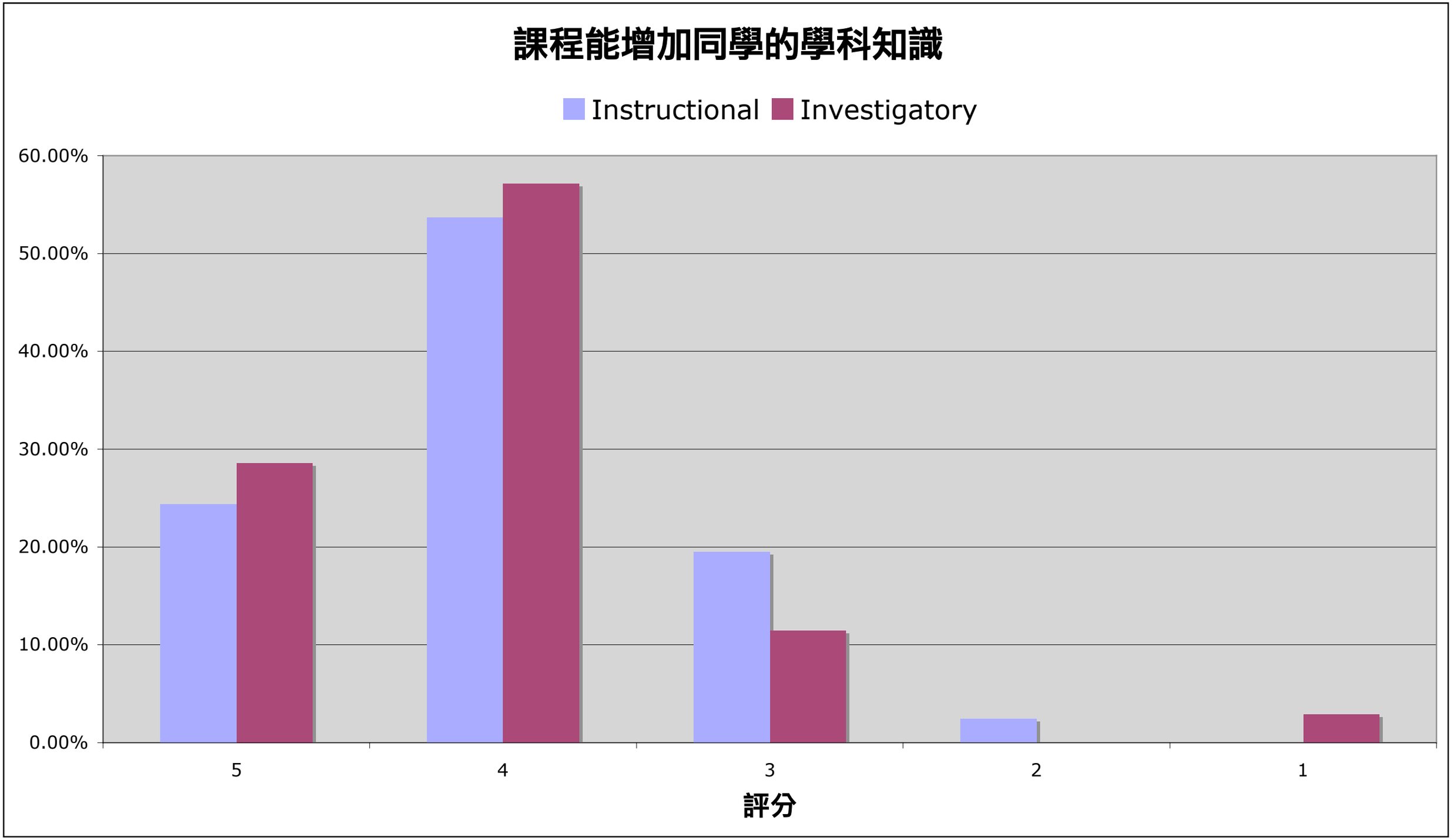

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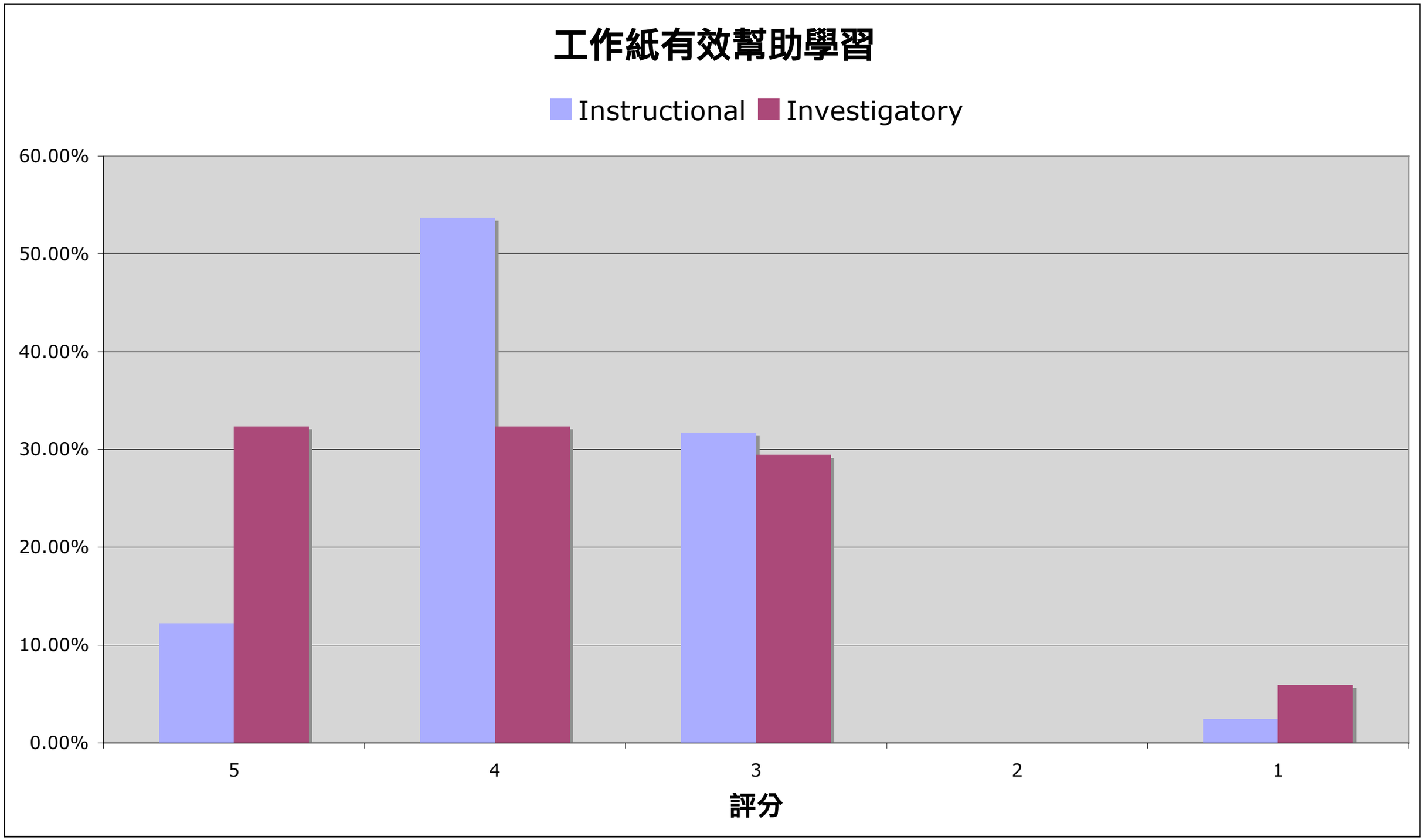

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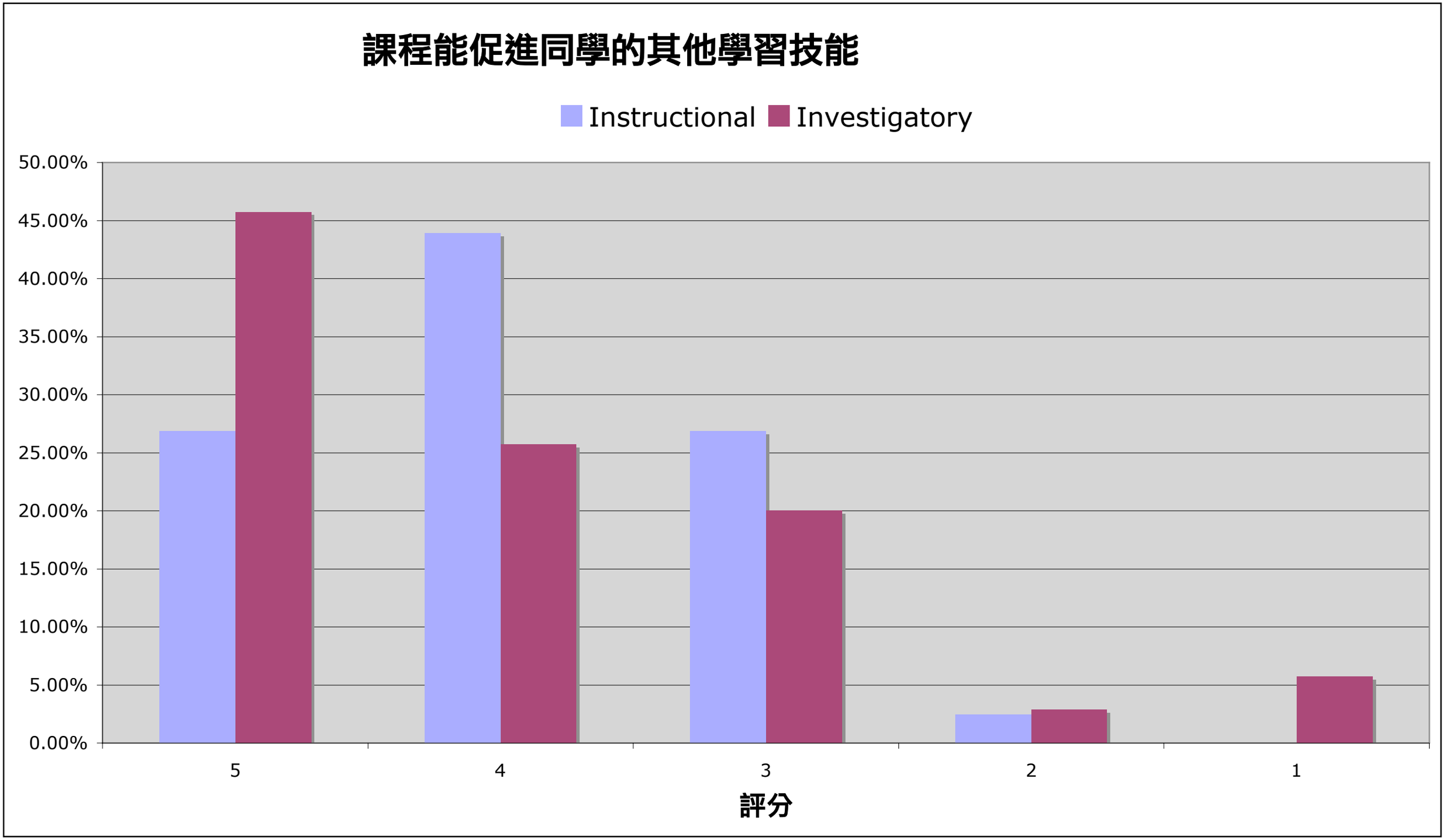

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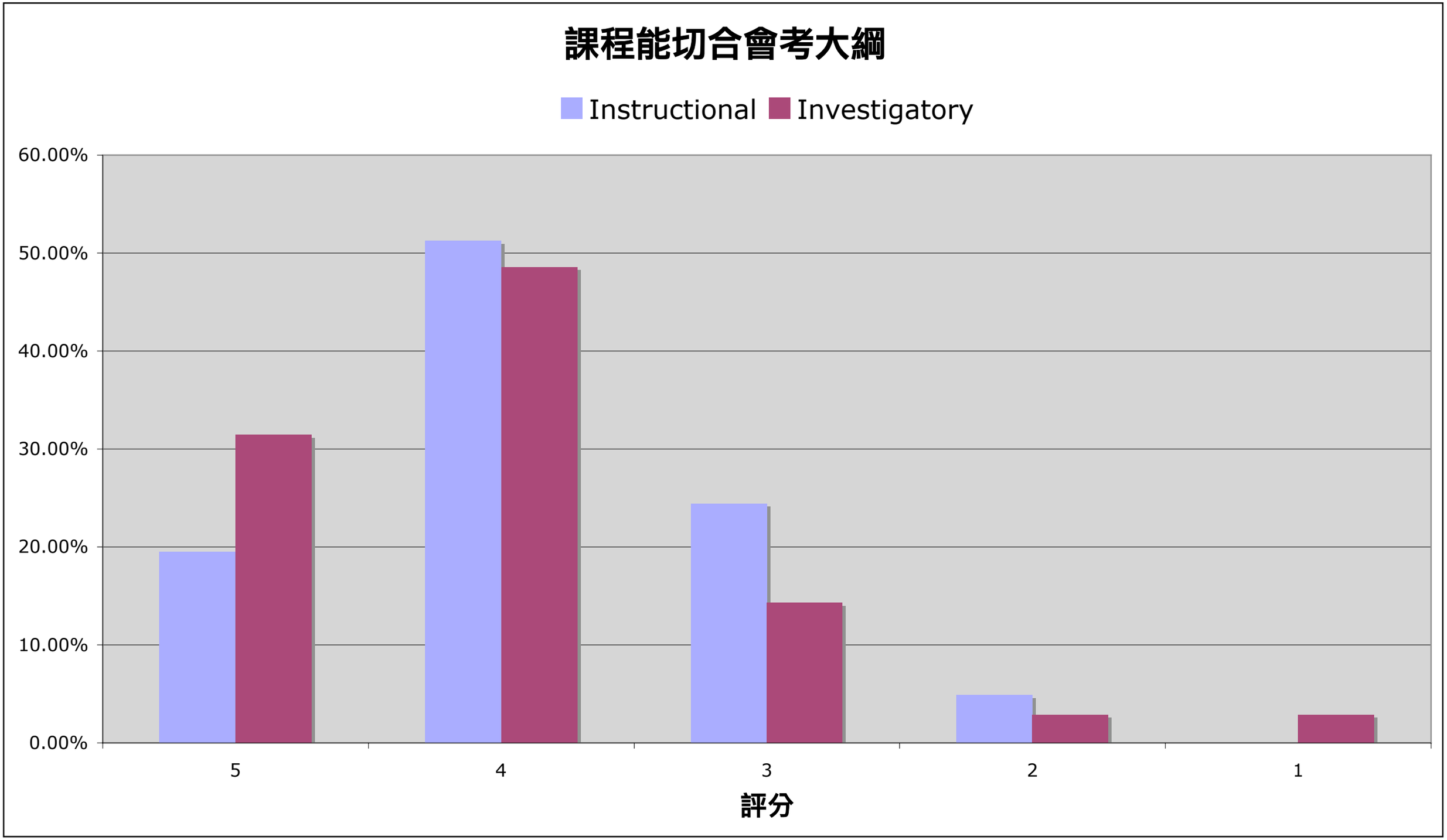
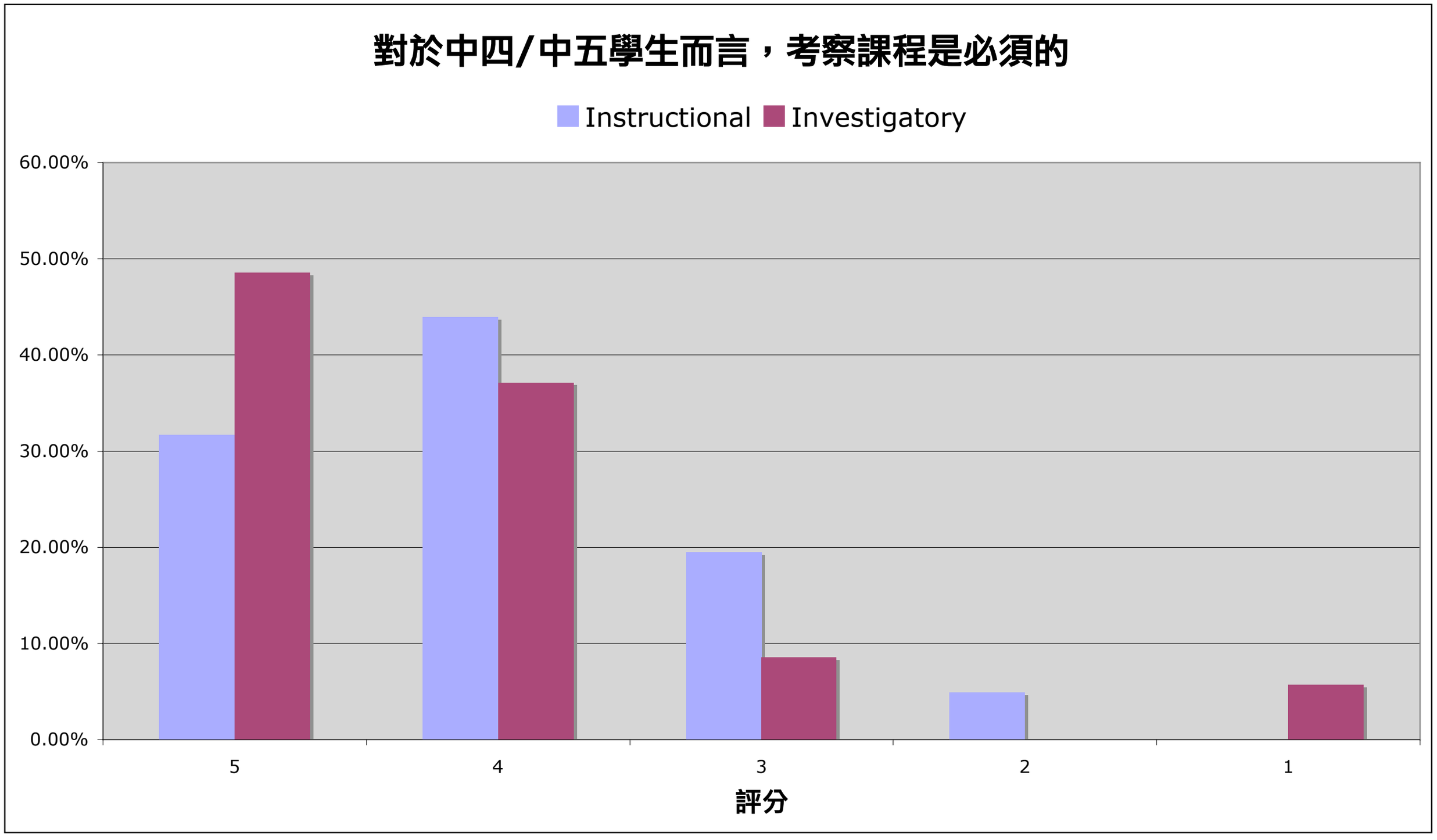


Instructional field study vs Investigatory field study

導向式野外研習　　探究式野外研習



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Summary

1. Students generally show positive responses to either approach of field study

2. Larger portion of students using investigatory approach give extremely high marks

3. 2-5% of students using investigatory approach do not accept the learning process

Investigatory field study 探 究 式 野 外 研 习

Practical Task - Component of an ecosystem (1) Topic III(f)

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Water flow is one of the most important abiotic factors affecting living organisms in a freshwater stream habitat. The biotic community may response in a various way to different water flow.

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Design and carry out an investigation to find out how does the water flow in a freshwater stream affect the freshwater animals.

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Design and carry out an investigation to find out how does the water flow in a freshwater stream affect the freshwater animals.

Write a full report for your investigation work and your findings.

Procedure and time arrangement

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- Group discussion and formulation of investigation plan – 50 mins

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- Distribution of equipment – 10 mins

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- Write up the full report

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- dependent variable and independent variable
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- modification of fins into sucker-like structure, e.g. Sucker-belly Loach, Broken-band Hillstream Loach, Goby. Diversity – species composition, e.g. number of fish species, number of insect species, number of mollusce species, etc.; relative abundance of each species may also be considered.

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- burrowing/dwelling into the substrate or rock crevices, e.g. Fishfly larvae, Damselfly nymphs, Stonefly nymphs, Shrimps, etc..
- build strong protective cases, e.g. Caddisfly larvae
- stay on the water surface , e.g. Water skater

Recommended procedures

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- Students may also measure the pH and Total Dissolved Solids by means of the TDS meter

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- Comparison of abiotic factor – water flow rate, better with other related factors, such as nature of substrate, dissolved oxygen, total suspended solids.

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- Brief description of the physical environment.

Result discussion

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- Merit should be given to those who further address the point that water flow does not only directly affect the anchorage of animals, it also indirectly affects the animals by influencing nature of the bottom material, availability of food and dissolved oxygen.

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- Students should point out the limitation/source of errors of this investigation, e.g. timing of investigation not representative enough(i.e. only in daytime and winter season), sample size may be too small to represent the reality, too many other variables in the real nature which cannot be completely controlled, apparatus are not too accurate, experimental error, etc..

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- No unnecessary killing of wild animals or over-collecting

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- Water sample placed in shade

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- Use various different methods to collect and high variety of animals have been collected


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施行及評核手冊
淡水溪流
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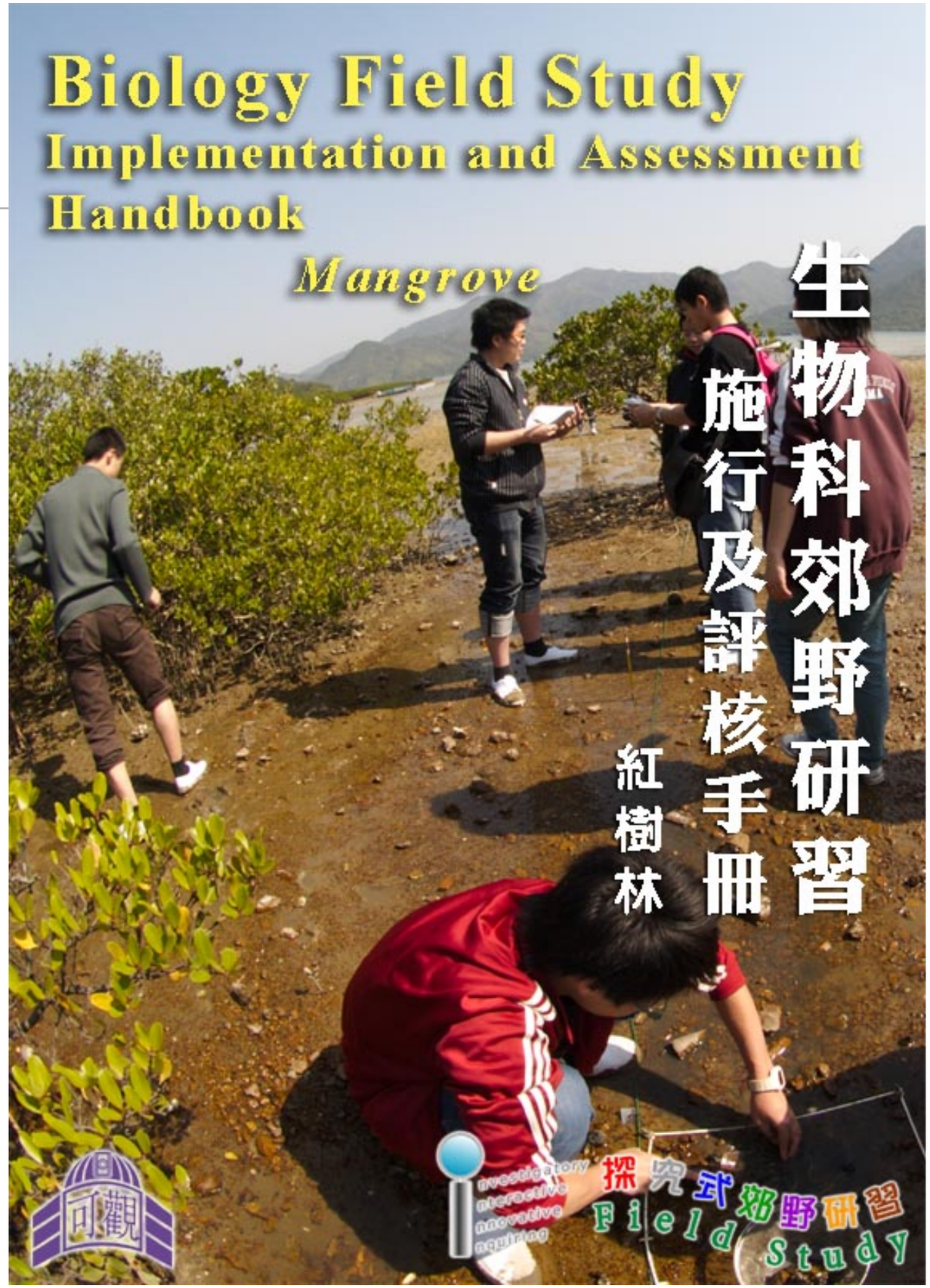
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