香港教育大學

The Education University of Hong Kong

Capstone Project - Technology-enhanced Field-based Learning in Secondary School Geography: Geographical Inquiry of Urban development and the Measurement of Environment Quality

Student name: Chu Miu Lam Catalina

Supervisor: Dr. Gwendolyn KL Wong

A Project submitted to the Education University of Hong Kong for the degree of Bachelor of Education (Honours) (Geography)

Date: April, 2021

Declaration

I, *Chu Miu Lam Catalina* declare that this research report represents my own work under the supervision o*f Dr. Gwendolyn KL Wong* , and that it has not been submitted previously for examination to any tertiary institution.

Chu Miu Lam Catalina

6/5/2021

Introduction

Field-learning experience is essential in Geography learning, however, it is difficult to have on-site field trips all the time. As reflected from Lai and Lam (2013), there are variety of challenges that the local schools in Hong Kong are facing when holding fieldworks for students, which are heavy workload of teachers and students, difficult to mobilize students to conduct independent fieldwork, tight teaching schedule, etc., making the field experiences hard to implement among the Geography students in Hong Kong. Moreover, under the Covid-19 epidemic, students are not able to go out for on-site field work, with the increasing importance of e-learning materials for teachers and students to have lessons at home, therefore, this capstone project is designed for the developing the essential fieldwork skills of the Geography students. Teaching and learning package is designed and the tryout session was carried out during March of 2021. Action research approach was used in this Capstone project, while in this report, there will be an examination and evaluation on the processes of the action research, further refinement will be made to improve the effectiveness of teaching.

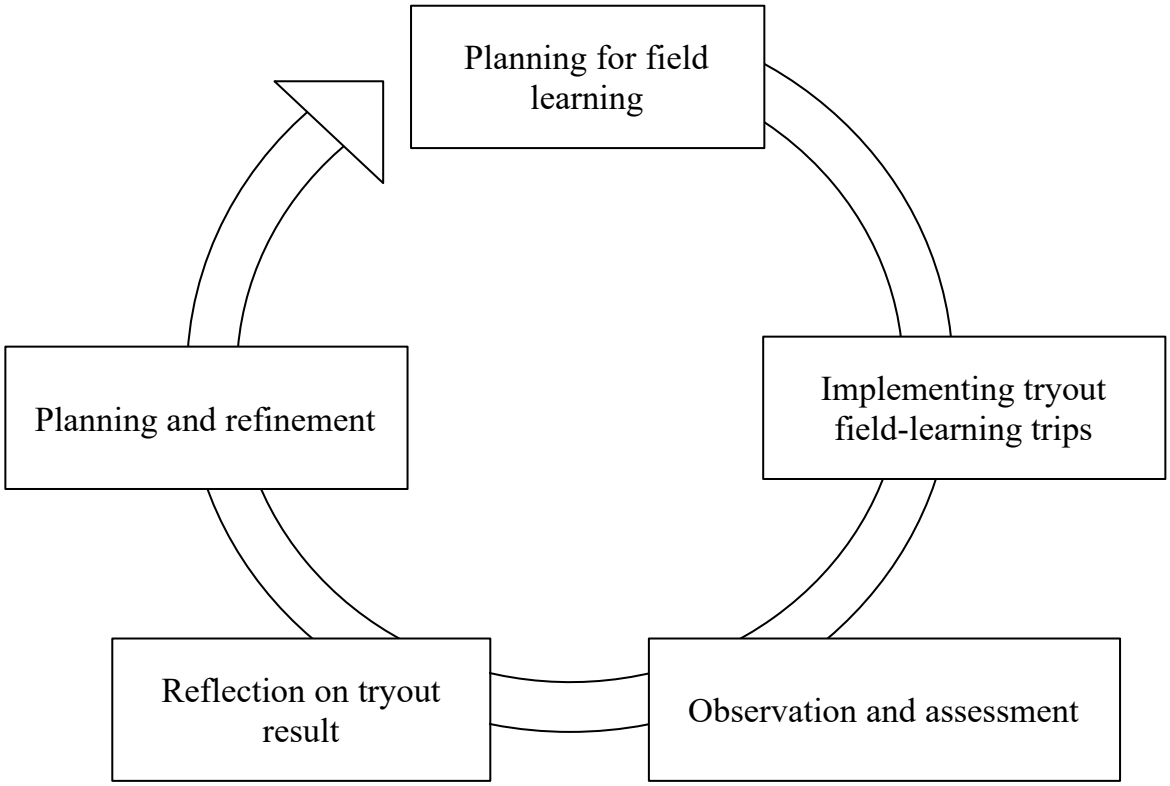


Figure 1: Action Research Cycle

Value of applying the action research

In this project, there will be a set of teaching and learning materials for fieldwork learning. Action research approach had been applied in the development of the teaching and learning package. According to Sagor (2000), "action research is a disciplined process of inquiry conducted *by* and *for* those taking the action. The primary reason for engaging in action research is to assist the "actor" in improving and/or refining his or her actions." Under the action research approach, the teacher has to plan, implement, evaluate and refine the teaching materials, this can enhance the quality of teaching, the teaching materials can be refined and fit the needs of different students. Sagor (2000) had mentioned that, with the action research approach, it can enhance teacher's motivation, and teachers can continuously improve their teaching.

Planning for field learning

The aims of this project are to develop the essential fieldwork skills of Geography students, so that teachers can carry out the teaching content related to fieldwork more effectively, at the same time, students can be more prepared in the on-site fieldwork. Job, Day and Smyth (as cited in Preston, 2016) described the fieldwork strategies into 5 degrees.

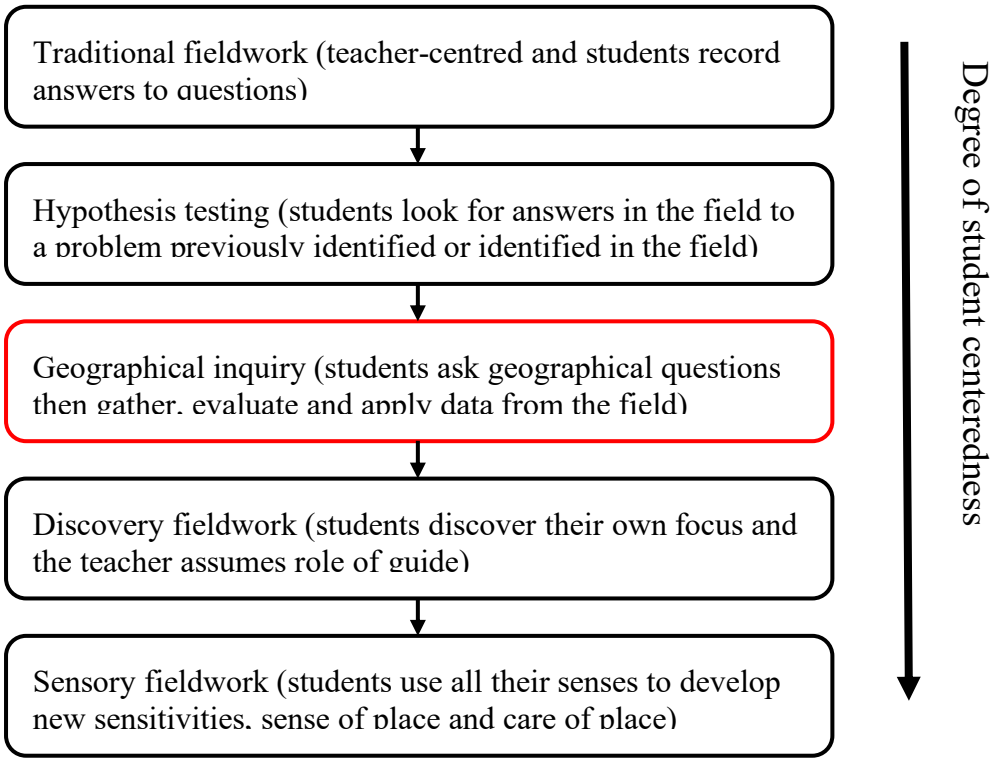


Figure 2: Degree of students centeredness in the fieldwork

The teaching and learning package in this project is mainly for developing the basic fieldwork skills, students who are new to field experience can have the opportunity to go through the 5 processes of fieldwork, which are "planning and preparation", "data collection", "data processing, presentation and analysis", "interpretation and conclusion" and "evaluation". The intended learning outcomes were set in each stage of the fieldwork, students can have a deeper understanding of the reasons for implementation of each stage and be more familiar with the research processes. The degree of students centeredness will be "Geography inquiry", which teacher would guide students to ask Geographical questions, collect data and evaluate the fieldwork. The assistance from teachers can be decreased according to the understanding and experience of the students about the fieldwork. In this virtual fieldwork, the topic would be "urban development and measurement of environmental quality", teachers can adopt this fieldwork through online classes or face to face class.

Implementing tryout field-learning trips

In March of 2021, a tryout session was held in SKH Li Fook Hing Secondary school, the participants were a group of S.5 students with no experience of the on-site fieldwork, while they have finished the unit of building the sustainable city. In lesson planning (refer to appendix 1), the teacher needs to take the leading role to guide the students in each process. The lesson starts with recapping the prior knowledge about the inner city and new town. In the "planning and preparation" stage, teacher guided students to come up with the hypothesis of "the closer to the CBD, the lower the urban environmental quality" and think of the reasons of choosing Wan Chai and Ma On Shan as the site for data collection. In the "data collection" stage, Google Earth was used to observe the urban environment and also used the measuring function to measure the distance between the site and the CBD. There are also videos and data that I took on the site in advance. Students also had the experience to try to measure the PM2.5 and noise level of the classroom. In the "data processing, presentation and analysis" stage, students need to present the data with graphs and analyze the trend. In the "interpretation and conclusion" stage, students make use of the data evidence to prove the hypothesis. Finally in the "evaluation" stage , to evaluate all the stages of the fieldwork and suggested ways to improve the fieldwork.

It is noted that students do not have much knowledge about fieldwork in the tryout session, therefore, the teacher needs to use more questions to guide students to answer. The lesson cannot be able to be finished within the class time of 90 minutes. 20 minutes more were used in the tryout session.

Observation and assessment

The worksheet is designed for students to learn about the fieldwork according to the 5 stages progressively, students could learn based on the flow of the worksheet and the guidance of the teacher. By observing the performance of answers in class as well as the worksheets, the effectiveness of the materials can be assessed. Students were able to identify and describe the inner city and new town, which shows that students have sufficient prior knowledge over the selected theme of fieldwork. In different stages, students are able to finish most of the tasks, In stage 1, students are able to come up with the pros and cons of choosing the field site as well as the time for data collection. In stage 2, most students could pick the proper data collection method and explain the usage of the equipment. In stage 3, they were able to observe the trend of the data. In stage 4, students were able to prove the hypothesis of the geographical terms. Finally, most students can evaluate different stages of the fieldwork and give suggestions to improve the fieldwork design.

However, students tend to answer the questions in point forms, the design of the worksheet can be further improved to guide the students in providing well-structured answers. Students need more support in the data presentation part, students were using different graphs to show the data in the first attempt and not all of the graphs can show the relationships between variables, more information or guidelines can be given in the worksheet.

Reflection on the tryout result

To evaluate the effectiveness of the teaching materials, some criteria was proposed.

1. Achievement of learning objectives
2. Usage of technology
3. Effectiveness of the use of technology (if it is necessary to use the specific technology in the session)
4. Smoothness of the fieldwork
5. Time management
6. Others (e.g. safety)

Table 3: Evaluation criteria of the tryout sessions

Most of the learning objectives were achieved, except for the skills of presenting the data that can be further improved by including more guidelines in the worksheet. Different kinds of technology were included in class such as Google Earth and the mobile logger, etc. and all of that were useful in class. However, there may be technical errors in using Google Earth, more photos or videos can be included in the powerpoint to prevent from the long waiting time for loading the website. In this tryout session, students took much time copying down the data from the checkpoints in Google Earth to their worksheet. And some time spent to solve the technical problem. Therefore the class overran for 20 minutes, the time management can be better. Finally, it was safe to have lessons in the classroom, similar to the normal Geography lessons.

Planning and refinement

After the tryout session, it is reflected that the teaching and learning package can be improved. The following paragraphs will list out the areas that need improvement regarding the lesson planning, worksheet and Google Earth design.

Lesson planning

As mentioned in the previous part, the time management can be improved. In the tryout session, the duration of the class was 90 minutes, however the actual class time was 110 minutes. It is considered that some of the activities can be eliminated or assigned to students as homework. There was no task assigned to students before or after the tryout session. In order to save time in the class for the fieldwork skills, the "prior knowledge" part, that is related to the unit of Building a Sustainable City, can be assigned to students before the class, so that they can have a basic idea of the theme of the lesson, teachers do not need to spend lots of time in explaining the theme of the fieldwork. On the other hand, the data collection process such as using the decibel meter to measure the noise level of the classroom has to be done in class, while the teacher can assign the environmental evaluation form to students, students can watch the videos in Google Earth and evaluate the city. Students can draw the radar chart after evaluating Wan Chai and Ma On Shan. It can be regarded as an assessment after the lesson to test students' understanding.

Worksheet and Google Earth design

As it is proposed that this set of teaching and learning packages is for students who do not have much experience in fieldwork, therefore the difficulty of the worksheet should be lower, there should be more assistance to students in answering the questions. Scaffolding is needed to fit the students' level. Take the example of the "data collection" part of the worksheet, in the former version, there was a table for students to write down the usage of the equipment and ways to increase the accuracy of the equipment, it might be too difficult for students to think of the answer and write down in a well-structured form. Therefore it is considered that there can be options for students to choose the correct way to use the equipment. When students have more experience in fieldwork, teachers can then require students to answer the questions in paragraph form. On the other hand, the videos in Google Earth can have some captions or voiceover to guide students to observe, which makes the focus of the video clearer for students.

Conclusion

To conclude, virtual fieldwork allows students to have a try of collecting data with the equipment in class. It can make the on-site fieldwork more smooth, as students had the experience of collecting data at school. Although the virtual field trips cannot fully replace the on-site fieldwork, it can help students to develop a mindset of the 5 stages of fieldwork. Students can be more independent in the fieldwork when they have more practice on it.

References

1. Sagor, Richard. (2000). *Guiding school improvement with action research*. Alexandria, Va: Assoc. for Supervision and Curriculum Development.
2. Ugurlu, N. (2011). Use of Geographical Information Systems (GIS) for Educational Purposes. *Social Studies Review, 50*(1), 79-88.
3. Lai, K., & Lam, C. (2013). School-based assessment of fieldwork in Hong Kong: Dilemmas and challenges. *Geography, 98*, 33-40.
4. Hong Kong Examination and Assessment Authority. (2013) Hong Kong Diploma of Secondary Education Examination - Information on School-based Assessment. Retrieved from http://www.hkeaa.edu.hk/DocLibrary/Media/Leaflets/SBA_pamphlet_E_web_re.pdf
5. Cowan, P., & Butler, R. (2013). Using location-aware technology for learning Geography in a real digital space outside the classroom. *Journal of Educational Multimedia and Hypermedia, 22*(3), 243-272.
6. Preston, L. (2016). Field "Work" vs "Feel" Trip: Approaches to Out-of-Class Experiences in Geography Education. *Geographical Education, 29*, 9.
7. Jarvis, C., Tate, N., Dickie, J., & Brown, G. (2016). Mobile Learning in a Human Geography Field Course. *Journal of Geography, 115*(2), 61-71.
8. Field Studies Council (2016). Geography Fieldwork. Retrieved from https://www.geography-fieldwork.org/gcse/urban/inner-cities/fieldwork/
9. Wood, A. (2020). Utilizing technology-enhanced learning in geography: Testing student response systems in large lectures. *Journal of Geography in Higher Education, 44*(1), 160-170.

Appendix 1 – Lesson plan for the tryout session

Lesson Plan

Name of unit/theme: Field Study (Online)
Issue/ Problem/ Topic: Building a sustainable city
Duration: 90 mins

Teaching Objectives/ Learning Outcomes（Knowledge / Skills / Attitudes）：

At the end of the lesson, students should be able to :

Knowledge

1. Demonstrate the 5 stages of fieldwork ("Planning and preparation", "data collection", "data processing, presentation and analysis", "interpretation and conclusion" and "evaluation")
2. Examine the advantage and disadvantage of the research methods used the fieldwork
3. Suggest ways to improve the fieldwork

Skills:

1. Use statistical approach to process the data collected
2. Present data with appropriate graphs

Attitudes:

1. Be aware of the urban problems and sustainable development of the city

Teaching resources / Tools / Equipment：

Google earth:
https://earth.google.com/web/@22.3534907,114.21367614,327.58343241a,32515.3675878d,30y,0h,0t,0r/data=MicKJQojCiExLVdmcUNBb2Q2aFl4NDlZMTc4b1NPR0Y4QlBhRlZJbnk6AwoBMA
Worksheet
Powerpoint
Decibel meter
Mobile logger
Timer

Blackboard/ Whiteboard Layout：

Write down students' answers on the board if necessary

Students' Previous Knowledge：

- Whole chapter of building sustainable city

Potential Learning Difficulties：

- Great learning diversity
- Students may have difficulties in using the online platforms

Time (min.)	Learning outcomes / Teaching Points / Content	Teaching Activities	Students' Tasks	Teaching Resources / Assessment / Remarks
10 mins	Introduction Recap of the previous knowledge Raise learning motivation	Introduction of the lesson • The purposes of the capstone project • The overview of the procedures of the virtual field trips Each student will have a set of worksheets and they will be assigned into groups. (3 students in a group) In order to recap the previous knowledge of the chapter about sustainable city, teacher asks students to use pens with different colours to recognize and mark down different areas in Hong Kong (1) The CBD; (2) The inner city; (3) The New Town *T: Mark down and label the CBD, Inner cities as well as the new town in Hong Kong with different colors, think of the difference between those areas.* *What are the differences between the environment of these 3 areas?*	Students use the pens to circle and mark the CBD, inner cities and the new town of Hong Kong. *Expected performance: Students are able to recognize Central as the CBD, Wan Chai as inner city, while students may not be familiar with the new towns in the new territories.*	PPT WS

			S: The CBD and inner cities are crowded, while the CBD has modern buildings, inner cities have old and short buildings. The new towns have better land use and are less crowded.	
		Teacher shows the selected areas (i.e. Central as the CBD, Wan Chai as the inner city and Ma On Shan as the new town) on Google Earth and ask students to identify and match photos with their explanations of the 3 areas. *T: Based on what you just said about the CBD, inner city and the new town, which of the districts shown on the photos on Google Earth match your description?*	*S:Central as the CBD, Wan Chai as the inner city and Ma On Shan as the new town*	
		The 3 districts will be the site of the virtual fieldwork. Teacher guides students to think of the hypothesis of the fieldwork. Relating the 2 field sites with the "urban environmental qualities" and "distance to the CBD", so that students can draw the hypothesis (i.e. the closer to the CBD, the lower urban environmental quality) *T: We have seen the street photos of the inner city and new town, which district would you choose to live in? Why would you choose this place to live? Why don't you choose the other one? Will you choose to live closer if you need to work in Central?* *What we are considering are the living environment and the distance to CBD. This is also our focus of today, we will collect data in the selected areas. Can you discuss and draw a hypothesis with your group member? Usually we set hypothesis with a statement and make assumptions of relationship of 2 variables*	*S: Ma On Shan, for a better living environment, more green space. Wan Chai is too crowded.* *Some students may still choose Ma On Shan for a better living environment, while some would choose Wan Chai for shorter commuting distance.* *Some students may have come up with the hypothesis* *"The closer to the CBD, the lower the urban environmental quality"* Students share their hypothesis to the classmates, and write it on the worksheet.	

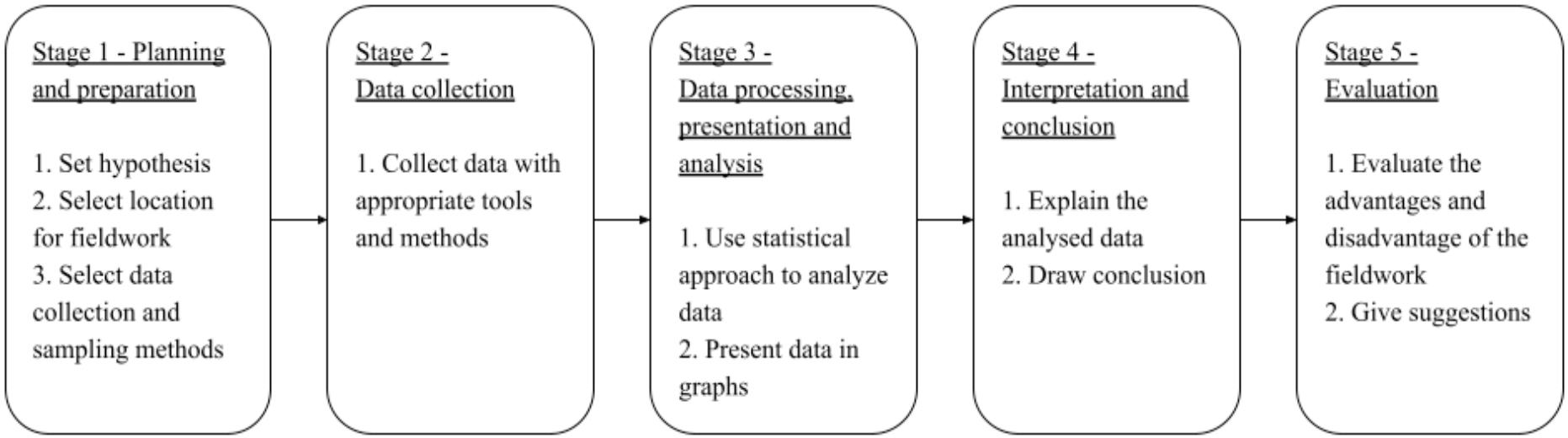
10 mins	Stage 1: Planning and preparation	After setting the hypothesis, the teacher guides students to think of what data to be collected in the field site. *T: So now we have set the hypothesis, we need to collect the data about the urban environment quality, what is included in it?* The place of data collection was Wan Chai and Ma On Shan, students need to consider the reason for picking these places. *E.g. accessibility of the 2 places, the time needed for travelling, time needed for the data collection process. Can it be finished by one day?Is it safe?*	Students may consider the *air quality and percentage of green space, etc.* as the criteria of measuring the urban environmental quality. *S: Wan Chai and Ma On Shan are having high accessibility and being well connected with public transports. Time in travelling between 2 places is within an hour.* *It takes around 2 hours in each place to collect data. It may need to be breaking down into 2 days for data collection* *The 2 places are relatively safe*	PPT WS
20mins	Stage 2: Data collection	After considering the criteria of urban environmental quality, it is time to think of how to collect data, what strategies or equipment can be used in this stage. Teacher then brings out different equipment such as the decibel meter, the mobile logger and a simple urban evaluation form. Teacher asks students about the usage of the equipment. Students can pick the data collection method out of the above choices, and explain why they would choose to use that equipment for data collection. *T: what is this equipment called? How do you use it? Describe it in a more detailed way according to the measurement in the field site. Which two of these equipment will you use in the field site?* • Students have no idea about the mobile logger, teacher needs to introduce it, and mentions the alternative equipments in measuring the air quality (i.e. The air quality detector)	For the decibel meter, students are expected to answer that it is used for measuring the sound level. For the evaluation form of the city, students are expected to answer that it is used to rate the outlook of the buildings as well as the green space. Students may pick the evaluation form as well as the mobile logger, which are observation and measuring.	PPT WS Decibel meter Mobile logger Evaluation forms

		As students already have the concept of how to use the equipments, teacher can allow students to use the decibel meter and mobile logger to measure the noise level and the PM2.5 level of the classroom, so that students can have the hands on experience of using the equipments Students are required to mark down the data collected on the worksheet. Referring to the field site, the teacher had already filmed some video clips of the data collection and the environment of the field site. Those videos were already included in Google Earth, students can watch the videos and read the information included in the checkpoints of Google Earth. Mark down the data if necessary. Apart from the data collected by the teacher in advance, students can also work on measuring the distance between the CBD and the checkpoint using the measuring function of the Google Earth. By viewing all the checkpoints in Google Earth, the teacher can guide students to think of how we decide to collect data in each checkpoint and what sampling method is used in this fieldwork. T: when we take a look at all the checkpoints in Wan Chai and Ma On Shan, name the landuse of the checkpoints. Refer to the common sampling methods, which one is applied in this fieldwork? What are the pros and cons of using such methods? • Students may forget the common sampling methods, and the teacher has to remind them if needed.	Students take turns to try to use the equipment. Students record the data. Students work as a team and record the data or evaluate the environmental quality using the resources attached in Google Earth. Students make use of the measuring function of Google Earth to measure the distance between CBD and each checkpoint. Jot it down in the worksheet Transport land use, residential land use and recreational land use Quota sampling is applied. Pros: convenient, low cost Cons: may have bias • Students may not be able to provide detailed answers, the teacher needs to guide students to think deeper.	

15mins	Stage 3: Data processing, presentation and analysing	With reference to the data collected in stage 2, students need to work as groups to think of how to present the data. The data is recorded in table form, students can use line graphs to show the result, such as showing the relationship between distance of CBD to the checkpoints and the noise level, PM2.5 level or the score of the evaluation form. The Teacher can let students think of the pros and cons of using the specific kind of graph to present the data, so that students can think deeper of what kind of graph is more suitable for presenting the data. • Students may not be able to come up with the cons directly, the teacher can draw 2 diagrams with different scales of the y-axis to show students that the presentation of the graph can be misleading.	Students try to present their data by plotting line graphs and explaining the relationships between the variables. Pros: easy to draw, clearly show the relationship between the 2 variables Cons: Can be misleading, if the y-axis is being exaggerated .	PPT WS
10mins	Stage 4: Interpretation and conclusion	With reference to the graphs drawn in the previous part, students need to interpret the data and draw a conclusion. Students discuss whether the hypothesis is valid or not based on the data collected. The teacher needs to guide students to draw the conclusion with data evidence and explain the result with the geographical concepts.	If students chose to measure the noise level of Wan Chai and Ma On Shan, there is no great difference between the 2 places. Students may draw a conclusion that the hypothesis was not valid If students chose to measure air quality and evaluate the environmental quality, they can come up with the conclusion that the hypothesis is valid	PPT WS
20mins	Stage 5: Evaluation	Evaluate each step of the fieldwork. Students had come across the 4 stages of the fieldwork, they had also written down the pros and cons in the previous stage of the fieldwork, which helps them during evaluation. The teacher assigns 1 stage for each group to evaluate the appropriateness of the arrangement of the fieldwork. Guiding questions would be provided in the worksheet or the powerpoints, students can refer to it and evaluate the fieldwork processes.	Students consider whether each step too in the fieldwork was appropriate or not. *Stage 1: the scale of the fieldwork is so big that it is difficult to measure 2 districts a morning.*	PPT WS

		The teacher invites each group to share their ideas.	*Stage 2: Quota sampling may contain bias, which makes the fieldwork not objective enough.* *There can be more checkpoints covering different land use rather than just 3 land uses.* *The equipment, especially the decibel meter may not be the most suitable equipment.* *It would be better to include a more comprehensive evaluation form.* *Stage 3:* *There is extreme data, better to cancel it when presenting the data.* *Data presented using line graphs could be misleading if the scale is not correct.* *Stage 4: the data is not enough to judge the hypothesis set as the term "urban environmental quality" covers a lot more than noise level/ air quality/ outlook of the buildings.* Students share their ideas to the classmate and jot down the key points in the worksheet	
5mins	Summarize the lesson and allow time for students to finish the worksheet	The teacher asks questions to students about the processes of the fieldwork to test students' understanding of the fieldwork Students may need time to polish the answer of the worksheet, the teacher allows time for them to finish it.	Students answer the questions Students finish the worksheet and hand in to the teacher	WS

Lesson Concept Map：



Post-lesson Activity / Task：

Fieldwork worksheet

Evaluation of Teaching：

Students' answers in class
Students' performance in the worksheet

Appendix 2 – Refined Lesson Plan

Lesson Plan

Name of unit/theme: Field Study (Online)
Issue/ Problem/ Topic: Building a sustainable city
Duration: 90 mins

Teaching Objectives/ Learning Outcomes（Knowledge / Skills / Attitudes）：

At the end of the lesson, students should be able to :

Knowledge

1. Demonstrate the 5 stages of fieldwork ("Planning and preparation", "data collection", "data processing, presentation and analysis", "interpretation and conclusion" and "evaluation")
2. Stage 1: Examine the location and time for data collection
3. Stage 2: Examine the advantage and disadvantage of the research methods used the fieldwork
4. Stage 4: interpret the data with Geographical concepts
5. Stage 5: Suggest ways to improve the fieldwork

Skills:

1. Stage 3: Present data with appropriate graphs

Attitudes:

1. Be aware of the urban problems and sustainable development of the city

Teaching resources / Tools / Equipment：

Google earth:
https://earth.google.com/web/@22.3534907,114.21367614,327.58343241a,32515.3675878d,30y,0h,0t,0r/data=MicKJQojCiExLVdmcUNBb2Q2aFl4NDlZMTc4b1NPR0Y4QlBhRlZJbnk6AwoBMA
Worksheet
Powerpoint
Decibel meter
Mobile logger

Timer

Blackboard/ Whiteboard Layout：

Write down students' answers on the board if necessary

Students' Previous Knowledge：

- Whole chapter of building sustainable city

Potential Learning Difficulties：

- Students may not be familiar with the online platform

Time (min.)	**Learning outcomes / Teaching Points / Content**	**Teaching Activities**	**Students' Tasks**	**Teaching Resources / Assessment / Remarks**
10 mins	Introduction Recap of the previous knowledge Raise learning motivation	Introduction of the lesson - The purposes of the capstone project - The overview of the procedures of the virtual field trips Teacher starts the lesson by checking the answer of the "prior knowledge" part of the worksheet ● Teacher assign the pre lesson task to students Teacher shows the selected areas (i.e. Central as the CBD, Wan Chai as the inner city and Ma On Shan as the	Student finish the pre lesson task before lesson starts *Expected performance: Central as the CBD, Wan Chai as inner city*	PPT WS

		new town) on Google Earth and ask students to identify and match photos with their explanations of the 3 areas. *T: Based on what you just said about the CBD, inner city and the new town, which of the districts shown on the photos on Google Earth match your description?* The 3 districts will be the site of the virtual fieldwork. Teacher guides students to think of the hypothesis of the fieldwork. Relating the 2 field sites with the "urban environmental qualities" and "distance to the CBD", so that students can draw the hypothesis (i.e. the closer to the CBD, the lower urban environmental quality) • Teacher needs to explain how to set the hypothesis • Students may have the idea of "variables" in Mathematics, teachers need to relate it to the data collection *T: We have seen the street photos of the inner city and new town, which district would you choose to live in? Why would you choose this place to live? Why don't you choose the other one? Will you choose to live closer if you need to work in Central?*	*S: The CBD and inner cities are crowded, while the CBD has modern buildings, inner cities have old and short buildings. The new towns have better land use and are less crowded.* *S:Central as the CBD, Wan Chai as the inner city and Ma On Shan as the new town* *S: Ma On Shan, for a better living environment, more green space. Wan Chai is too crowded.* *Some students may still choose Ma On Shan for a better living environment* *Choose Wan Chai for shorter commuting distance.* *Hypothesis: "The closer to the CBD, the lower the urban environmental quality"* Students share their hypothesis to the classmates, and write it on the worksheet.	

10 mins	Stage 1: Planning and preparation	After setting the hypothesis, the teacher guides students to think of what data to be collected in the field site. The place of data collection was Wan Chai and Ma On Shan, students need to consider the reason for picking these places. *E.g. accessibility of the 2 places, the time needed for travelling, time needed for the data collection process. Can it be finished by one day?Is it safe?*	Students may consider the *air quality and percentage of green space, etc.* as the criteria of measuring the urban environmental quality. *S: Wan Chai and Ma On Shan are having high accessibility and being well connected with public transports.* *Time in travelling between 2 places is within an hour.* *It takes around 2 hours in each place to collect data. It may need to be breaking down into 2 days for data collection* *The 2 places are relatively safe*	PPT WS
20mins	Stage 2: Data collection	After considering the criteria of urban environmental quality, it is time to think of how to collect data, what strategies or equipment can be used in this stage. Teacher then brings out different equipment such as the decibel meter, the mobile logger and a simple urban evaluation form. • Mobile logger can be replaced by air quality meter Teacher asks students about the usage of the equipment. Noise level and air quality would be the data collected in the field site As students already have the concept of how to use the equipments, teacher can allow students to use the decibel meter and mobile logger to measure the noise level and	For the decibel meter, students are expected to answer that it is used for measuring the sound level. For the evaluation form of the city, students are expected to answer that it is used to rate the outlook of the buildings as well as the green space. Students discuss and write down the usage of the equipments on the worksheet	PPT WS Decibel meter Mobile logger Evaluation forms

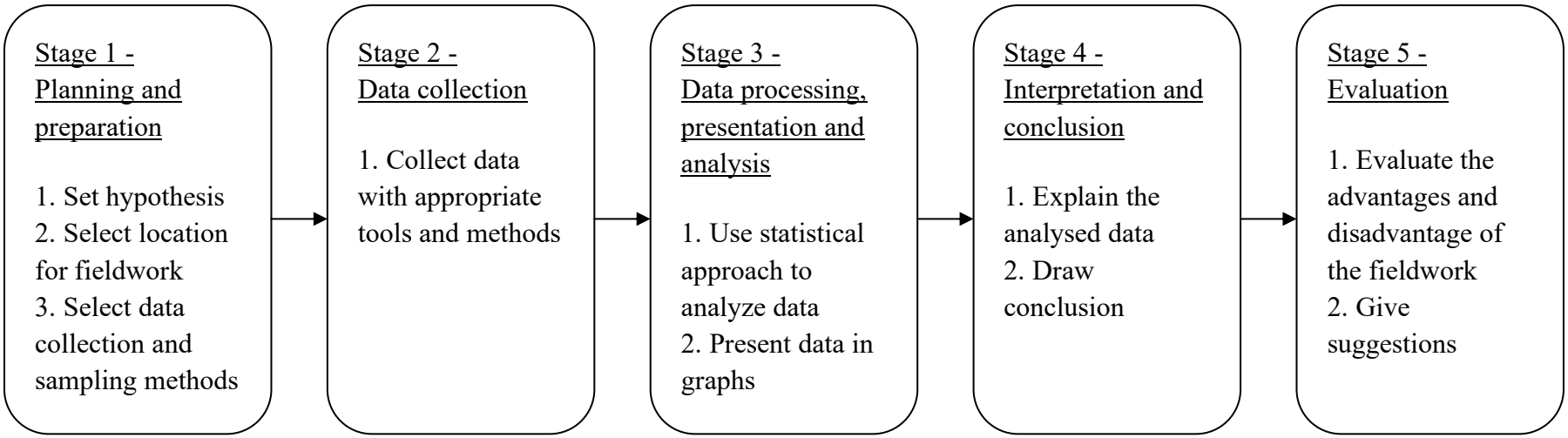
		the PM2.5 level of the classroom, so that students can have the hands on experience of using the equipments • Teacher can mark the data collected on the blackboard	Students take turns to try to use the equipment. Students record the data	
		Referring to the field site, the teacher had already filmed some video clips of the data collection and the environment of the field site. Those videos were already included in Google Earth, students can watch the videos and read the information included in the checkpoints of Google Earth. Mark down the data if necessary.	Students work as a team and record the data or evaluate the environmental quality using the resources attached in Google Earth.	
		Apart from the data collected by the teacher in advance, students can also work on measuring the distance between the CBD and the checkpoint using the measuring function of the Google Earth.	Students make use of the measuring function of Google Earth to measure the distance between CBD and each checkpoint. Jot it down in the worksheet	
		By viewing all the checkpoints in Google Earth, the teacher can guide students to think of how we decide to collect data in each checkpoint and what sampling method is used in this fieldwork. T: when we take a look at all the checkpoints in Wan Chai and Ma On Shan, name the landuse of the checkpoints. Refer to the common sampling methods, which one is applied in this fieldwork? What are the pros and cons of using such methods? • It is suggested that teachers can assign students to read sampling methods in advance to smoothen the class	Transport land use, residential land use and recreational land use Quota sampling is applied. Pros: convenient, low cost Cons: may have bias • Students may not be able to provide detailed answers, the teacher needs to guide students to think deeper.	

15mins	Stage 3: Data processing, presentation and analysing	With reference to the data collected in stage 2, students need to work as groups to think of how to present the data. The data is recorded in table form, students can use line graphs to show the result, such as showing the relationship between distance of CBD to the checkpoints and the noise level, PM2.5 level or the score of the evaluation form. The Teacher can let students think of the pros and cons of using the specific kind of graph to present the data, so that students can think deeper of what kind of graph is more suitable for presenting the data. ● Students may not be able to come up with the cons directly, the teacher can draw 2 diagrams with different scales of the y-axis to show students that the presentation of the graph can be misleading.	Students try to present their data by plotting line graphs and explaining the relationships between the variables. Pros: easy to draw, clearly show the relationship between the 2 variables Cons: Can be misleading, if the y-axis is being exaggerated .	PPT WS
10mins	Stage 4: Interpretation and conclusion	With reference to the graphs drawn in the previous part, students need to interpret the data and draw a conclusion. Students discuss whether the hypothesis is valid or not based on the data collected. The teacher needs to guide students to draw the conclusion with data evidence and explain the result with the geographical concepts.	If students chose to measure the noise level of Wan Chai and Ma On Shan, there is no great difference between the 2 places. Students may draw a conclusion that the hypothesis was not valid If students chose to measure air quality and evaluate the environmental quality, they can come up with the conclusion that the hypothesis is valid	PPT WS
20mins	Stage 5: Evaluation	Evaluate each step of the fieldwork. Students had come across the 4 stages of the fieldwork, they had also written down the pros and cons in the previous stage of the fieldwork, which helps them during evaluation.	Students consider whether each step too in the fieldwork was appropriate or not.	PPT WS

		The teacher assigns 1 stage for each group to evaluate the appropriateness of the arrangement of the fieldwork. Guiding questions would be provided in the worksheet or the powerpoints, students can refer to it and evaluate the fieldwork processes. The teacher invites each group to share their ideas.	*Stage 1: the scale of the fieldwork is so big that it is difficult to measure 2 districts a morning.* *Stage 2: Quota sampling may contain bias, which makes the fieldwork not objective enough.* *There can be more checkpoints covering different land use rather than just 3 land uses.* *The equipment, especially the decibel meter may not be the most suitable equipment.* *It would be better to include a more comprehensive evaluation form.* *Stage 3:* *There is extreme data, better to cancel it when presenting the data.* *Data presented using line graphs could be misleading if the scale is not correct.* *Stage 4: the data is not enough to judge the hypothesis set as the term "urban environmental quality" covers a lot more than noise level/ air quality/ outlook of the buildings.* Students share their ideas to the classmate and jot down the key points in the worksheet	
5mins	Summarize the lesson and allow time for students to finish the worksheet	The teacher asks questions to students about the processes of the fieldwork to test students' understanding of the fieldwork	Students answer the questions	WS

		Assign the urban environmental evaluation and the radar chart as the assignment to students	Students watch the videos on the Google Earth and finish the worksheet	

Lesson Concept Map：



Pre-lesson Activity / Task:

"Prior knowledge" Part of the worksheet

Post-lesson Activity / Task：

Fieldwork worksheet "urban environmental evaluation"

Evaluation of Teaching：

Students' answers in class
Students' performance in the worksheet

Appendix 3 – Worksheet in the tryout seession

虛擬實地考察

中五級

學生姓名：_____ 班別（學號）：_____(　　)

課題：建設一個可持續發展的城市 - 城市發展帶來的污染問題

前備知識

圖一為香港地圖，當中劃分了十八個地區

圖一）香港地圖

1. 試在圖一中圈出並標記
   i）商業中心區；ii）內城區；iii）新市鎮
2. 內城區大多位於商業中心區的_____。
3. 內城區內普遍存在著甚麼城市問題？

   _____

   _____
4. 新市鎮大多位於_____。
5. 新市鎮有比較完善的_____。

階段一：構思和預備實地考察

考察地區	 **內城區**	 **新市鎮**
與商業中心區的距離	較近 / 較遠	較近 / 較遠
城市衰落問題	較嚴重 / 較輕微 / 相似	較嚴重 / 較輕微 / 相似
城市環境質素	較理想 / 較惡劣	較理想 / 較惡劣

訂立假設：

_____

考察地點： 灣仔 及 馬鞍山	優點：_____ 缺點：_____
考察日期：12/3（五） 考察時間： 早上 （8:30 a.m.- 12:00 n.n.)	優點：_____ 缺點：_____

階段二：搜集數據

根據**階段一**所訂立的假設，我們應該搜集甚麼數據？

_____

_____

試提出相關數據搜集的方法。

- ❑ 拍照觀察
- ❑ 量度
- ❑ 統計數量
- ❑ 評分
- ❑ 地圖製作
- ❑ 問卷及訪談
- ❑ 二手資料

選擇合適的儀器或工具，描述其用途及提升數據準確度的方法。

	儀器/工具	**用途**	**如何提升數據的準確度？**
	環境質素評估 （附件一）		
	計時器		
	便攜式環境數據記錄器 （附件二）		
	噪音計 （附件二）		
	地圖 (Google Earth)		

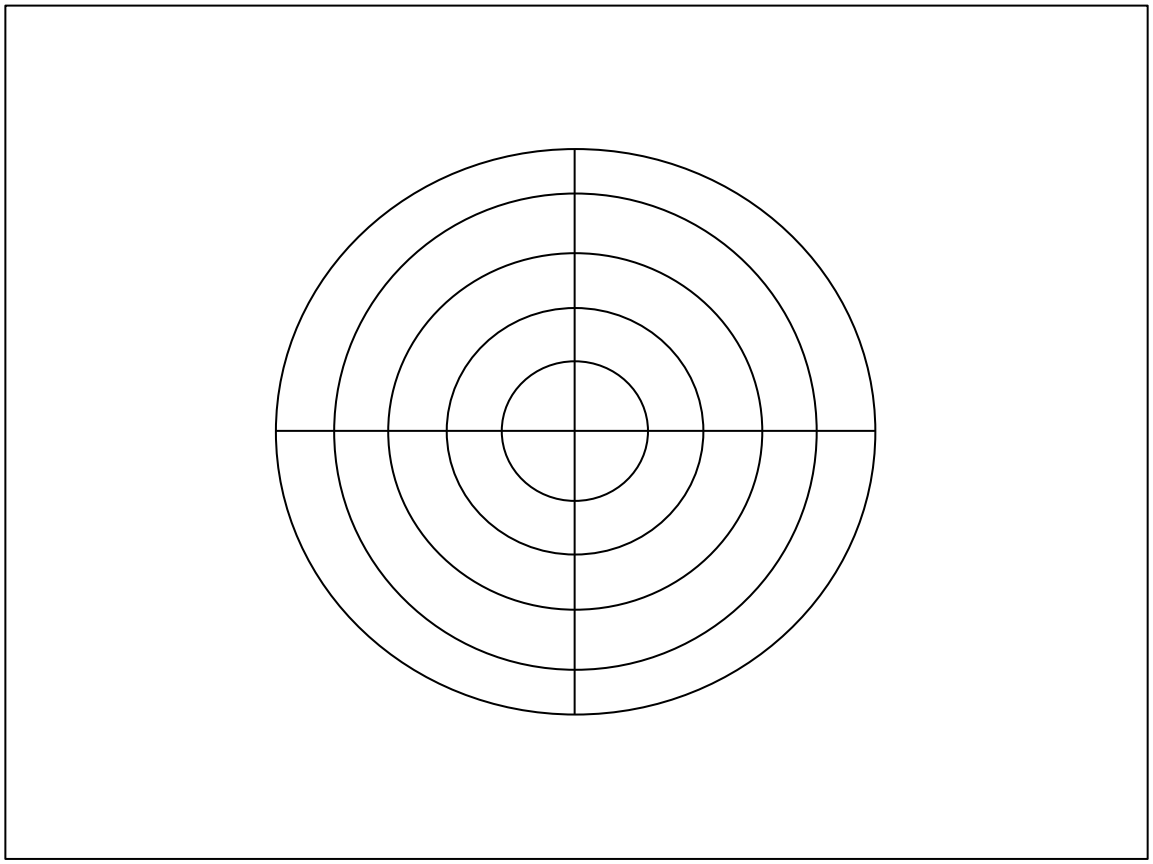
以 Google Earth 進行環境觀察及量度，使用**附件一和附件二**的表格來記錄量度數據。

抽樣方法：隨機 / 系統 / 分層 / 定額 / 便利

優點：_____ 缺點：_____

階段三：處理、分析和展示數據

搜集數據後，我們還需處理及分析數據，並以圖表的形式展示。



雷達圖能展示_____個以上的變量，常用來展示_____。

使用雷達圖

優點：_____

缺點：_____

我們可以使用_____來展示兩個變量之間的關係。（參閱附件三）

使用_____

優點：_____

缺點：_____

階段四：闡釋結果和定下結論

描述考察證據與圖表資料闡釋數據，檢視假設是否成立。描述和解釋變量的關係從而定下結論。

- 階段二所訂立的假設是否成立？

_____

- 提供數據證據。

_____

_____

_____

- 以地理概念詳細解釋結果。

_____

_____

_____

_____

闡釋雷達圖時可探討的層面	闡釋線形圖時可探討的層面
● 整體評分 ● 最高/最大值；最低/最小值	● 最高/最大值；最低/最小值 ● 有沒有極端數據 ● 整體趨勢 ● 預測趨勢 ● 直線/曲線的坡度

階段五：評估

在考察後，我們可以提出一些有關步驟一至四的問題，以改善這次考察的設計、數據搜集的方法，以及處理、分析、展示和闡釋數據。

	評估及建議（舉例說明）
<u>階段一：構思和預備實地考察</u> ● 考察題目是否有明確的重點？ ● 考察地點的大小是否適中？ ● 考察地點及時間是否安全？ ● 考察地點是否容易到達？ ● 所選時間是否適合搜集數據？	
<u>階段二：搜集數據</u> ● 抽樣方式是否合適？是主觀還是客觀的方法？ ● 抽樣的數量及地點是否足夠？ ● 搜集數據的方法是否客觀？ ● 選用的儀器是否合適？如何提升其準確度？	
<u>階段三：處理、分析和展示數據</u> ● 使用了甚麼處理和分析數據的方法？方法是否適合？ ● 這麼展示數據？展示方法是否合適？	
<u>階段四：闡釋結果和定下結論</u> ● 能否在搜集到的數據中觀察到任何關係、趨勢或型態？ ● 所得的數據是否足以定下有效的結論？ ● 所得結果與預期有多不同？能解釋當中差別嗎？	

附件一：環境質素調查記錄表

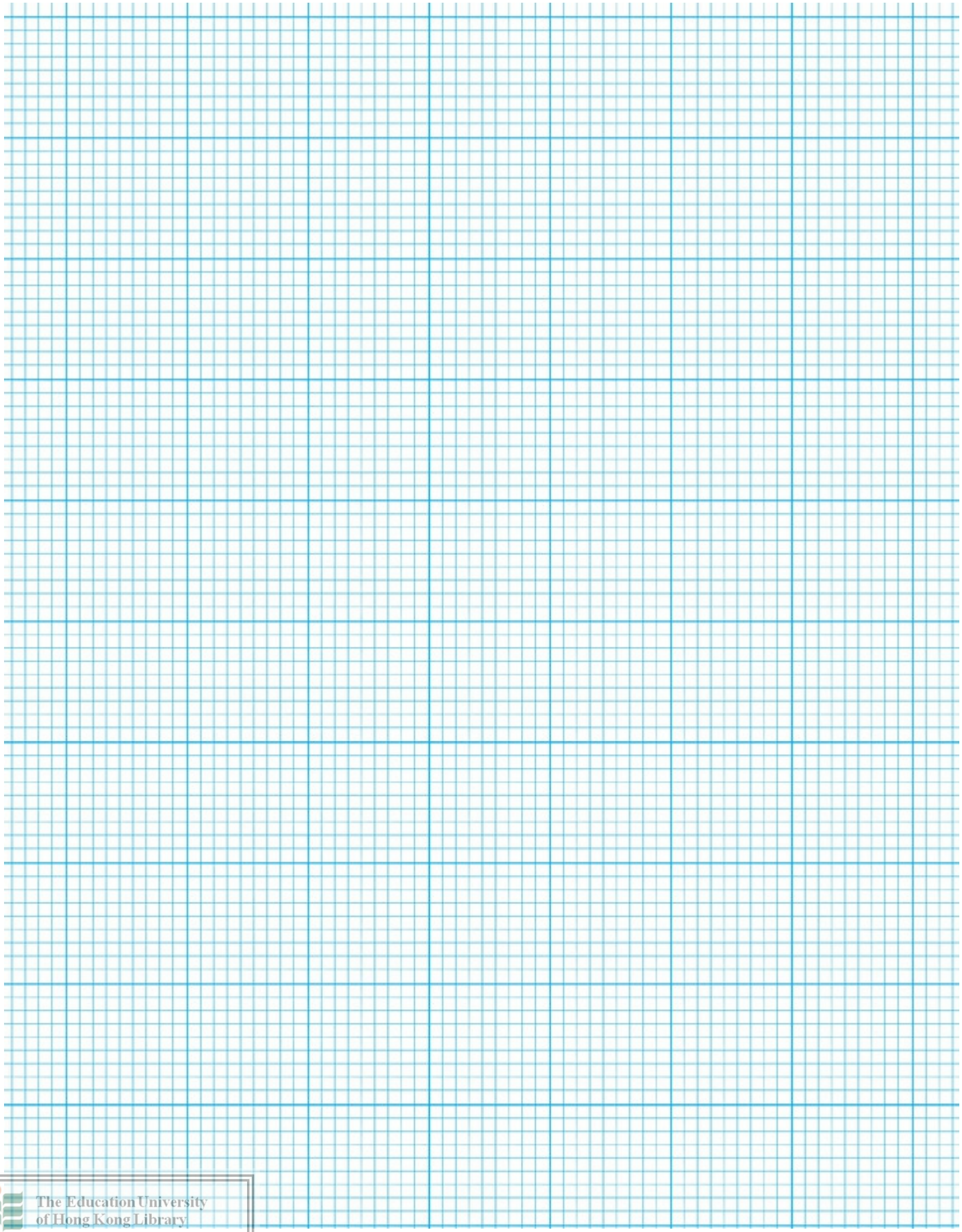
日期：		
環境質素評估		
街景質素和景色 好（3）	一般（2）	差（1）
樓宇保養/外部維修 好（3）	一般（2）	差，例如有塗鴉，朽木和漆面剝落（1)
綠化景觀 大量，有公園或綠化空間（3）	適量，有灌木或盆栽（2）	甚少或沒有（1）
街道狀況 空間充裕，清潔寧靜（3）	略爲擁擠，有垃圾和一些交通噪音（2）	擁擠、骯髒、嘈吵（1）

		考察點							
		灣仔				馬鞍山			
		A	B	C	D	E	F	G	H
土地利用									
與商業中心區之間的距離（公里）									
城市環境質素評分	第一組								
	第二組								
	第三組								

附件二）噪音及空氣質量記錄表

時間	地點	與商業中心區之間的距離	環境聲量（分貝）	空氣質素
				PM2.5 水平

附件三：方格紙



Appandix 4 – Refined WS

虛擬實地考察

中五級

學生姓名：_____　　班別（學號）：_____(　　)

課題：建設一個可持續發展的城市 - 城市發展帶來的污染問題

前備知識

圖一為香港地圖，當中劃分了十八個地區，在圖一完成第一題

圖一）香港地圖

1. 試在圖一中圈出並標記
   I）商業中心區；ii）內城區；iii）新市鎮

2. 內城區大多位於商業中心區的_____。

3. 內城區內普遍存在著甚麼城市問題？

   _____

4. 新市鎮大多位於_____。

5. 新市鎮有比較完善的_____。

階段一：構思和預備實地考察

考察地區	 **內城區**	 **新市鎮**
與商業中心區的距離	較近 / 較遠	較近 / 較遠
城市衰落問題	較嚴重 / 較輕微 / 相似	較嚴重 / 較輕微 / 相似
城市環境質素	較理想 / 較惡劣	較理想 / 較惡劣

訂立假設：

_____

考察地點： 灣仔 及 馬鞍山	優點：_____ 缺點：_____
考察日期：12/3（五） 考察時間： 早上 （8:30 a.m.- 12:00 n.n.)	優點：_____ 缺點：_____

應該考慮的事項

安全	可達度	考察範圍	交通費用	交通所需時間

階段二：搜集數據

根據**階段一**所訂立的假設，我們應該搜集甚麼數據？

_____

_____

試提出相關數據搜集的方法。

- ❑ 拍照觀察
- ❑ 量度
- ❑ 統計數量
- ❑ 評分
- ❑ 地圖製作
- ❑ 問卷及訪談
- ❑ 二手資料

選擇合適的儀器或工具，描述其用途及提升數據準確度的方法。

	儀器/工具	**用途**	**如何提升數據的準確度？**
	環境質素評估 （附件一）		❑ 培訓數據搜集員 ❑ 校正和測試儀器
	噪音計 （附件二）		❑ 讀取樣本後，必須清潔儀器菜再讀取下一個樣本 ❑ 多取數個讀數，計算平均值
	便攜式環境數據記錄器 （附件二）		❑ 多取數個讀數，計算平均值 ❑ 以多部儀器進行測量
	計時器		/
	地圖 (Google Earth)		/

以 Google Earth 進行環境觀察及量度，使用**附件一和附件二**的表格來記錄量度數據。

想一想

抽樣方法：隨機 / 系統 / 分層 / 定額 / 便利　　*考慮的事項：成本、可行性、人為偏差.....

優點：_____

缺點：_____

階段三：處理、分析和展示數據

搜集數據後，我們還需處理及分析數據，並以圖表的形式展示。

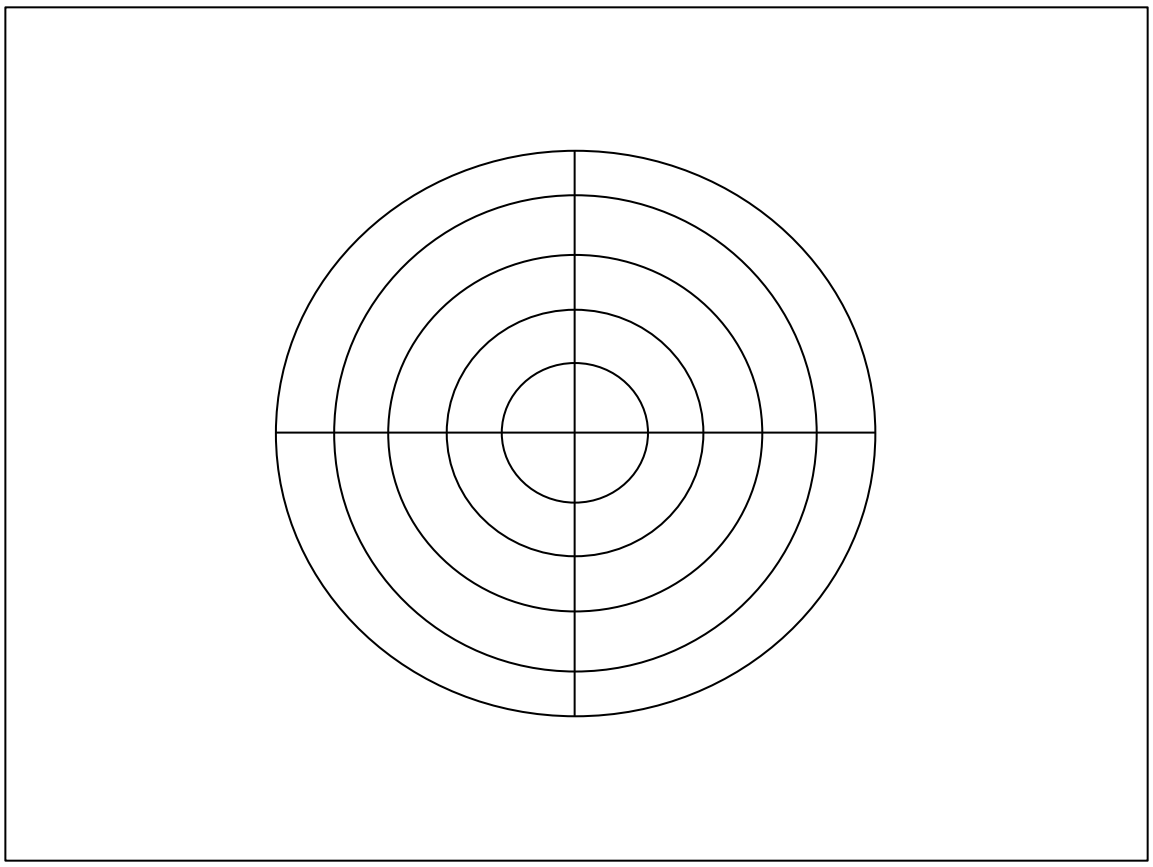
(一）我們可以使用_____來展示兩個變量之間的關係。（參閱附件三）

使用_____

優點：_____

缺點：_____

（二）



雷達圖能展示_____個以上的變量，常用來展示_____。

使用雷達圖

優點：_____

缺點：_____

階段四：闡釋結果和定下結論

描述考察證據與圖表資料闡釋數據，檢視假設是否成立。描述和解釋變量的關係從而定下結論。

- 階段二所訂立的假設是否成立？

_____

- 提供數據證據。

_____

_____

_____

- 以地理概念詳細解釋結果。

_____

_____

_____

_____

闡釋雷達圖時可探討的層面	闡釋線形圖時可探討的層面
● 整體評分 ● 最高/最大值；最低/最小值	● 最高/最大值；最低/最小值 ● 有沒有極端數據 ● 整體趨勢 ● 預測趨勢 ● 直線/曲線的坡度

階段五：評估

在考察後，我們可以提出一些有關步驟一至四的問題，以改善這次考察的設計、數據搜集的方法，以及處理、分析、展示和闡釋數據。

	評估及建議（舉例說明）
階段一：構思和預備實地考察 ● 考察地點的大小是否適中？ ● 考察地點及時間是否安全？ ● 考察地點是否容易到達？	_____ _____ _____
階段二：搜集數據 ● 抽樣方式是否合適？是主觀還是客觀的方法？ ● 選用的儀器是否合適？如何提升其準確度？	_____ _____ _____ _____
階段三：處理、分析和展示數據 ● 使用了甚麼處理和分析數據的方法？方法是否適合？ ● 這麼展示數據？展示方法是否合適？	_____ _____ _____ _____
階段四：闡釋結果和定下結論 ● 所得的數據是否足以定下有效的結論？ ● 所得結果與預期有多不同？能解釋當中差別嗎？	_____ _____ _____ _____

附件一：環境質素調查記錄表

日期：		
環境質素評估		
街景質素和景色 好（3）	一般（2）	差（1）
樓宇保養/外部維修 好（3）	一般（2）	差，例如有塗鴉，朽木和漆面剝落（1)
綠化景觀 大量，有公園或綠化空間（3）	適量，有灌木或盆栽（2）	甚少或沒有（1）
街道狀況 空間充裕，清潔寧靜（3）	略爲擁擠，有垃圾和一些交通噪音（2）	擁擠、骯髒、嘈吵（1）

		考察點							
		灣仔				馬鞍山			
		A	B	C	D	E	F	G	H
土地利用									
與商業中心區之間的距離（公里）									
城市環境質素評分	第一組								
	第二組								
	第三組								

附件二）噪音及空氣質量記錄表

時間	地點	與商業中心區之間的距離	環境聲量（分貝）	空氣質素
				PM2.5 水平
08:02	新港城巴士總站（馬鞍山交通交匯處對出）		77.6dB	47
			73.8dB	43
			76.2dB	43
9:04	耀安村		77.1dB	28
			81.8dB	29
			74.5dB	31
9:30	馬鞍山海濱		63dB	24
			85dB	26
			64dB	27
9:51	馬鞍山西沙路花園		62.6dB	28
			58.9dB	26
			57dB	24
8:32	利東街入口（合和中心對出）		79.9 dB	49
			75.8 dB	49
			77.7 dB	48
8:46	利東街內（囍匯）		74.8 dB	45
			70.5 dB	45
			65.8 dB	45
9:03	石水渠街（藍屋）		69.2 dB	48
			69.5 dB	48
			69.9 dB	53
9:18	石水渠街花園		73.2 dB	38
			77.1 dB	38
			74.5 dB	40

附件三：方格紙