

高雄市 113 年度第 43 屆國民中小學科學園遊會計畫書

學校名稱	高雄市三民區民族國小
活動名稱	(侏儸紀公園——探究恐龍)
指導老師	劉晏企、焦恆永、黃佳媛、陳雅慈

一、活動主旨

- (一)原理一：光線是以直線或反射的方式進入視覺的。利用恐龍的視角來觀看物體的影像。
- (二)原理二：拉動彈簧以連桿來傳遞動能。以手指拉動連動裝置可觀察到恐龍前爪的運動情形。
- (三)原理三：當氣流快速通過薄膜時會引起來回振動而產生聲音。以狹縫吸管來吹動鬆緊不同的薄膜來製造出高低不同的類恐龍的聲音。
- (四)雙語自然科學探究：利用恐龍頭、手部模型來動手操作、體驗恐龍在視覺上、聽覺上、與觸覺上與人類的不同並理解差異的演變，並培養學生科學素養、知識等探究能力。

二、目標單字與句型

(一)目標單字

恐龍 (dinosaur)、霸王龍 (tyrannosaurus rex 簡寫 T. rex)、視野 (vision)、重疊 (overlap)、頭部構造 (Head structure)、顳嚙孔 (temporal openings、Infratemporal fenestra)、顳骨 (temporal bone)、眶前孔 (antorbital fenestra)、前肢 (Forelimb)、連桿傳動方式 (mechanical linkage)、聲音 (sound)

(二)目標句型

1. 藍紫色孔龍頭模型的雙眼中可以看到(重疊、無法重疊)的影像?……無法重疊
2. 恐龍前肢模型是利用到哪種機械原理來達到仿生的動作呢?……連桿傳動方式 (mechanical linkage)
3. 聲音模組是利用高速氣流來讓薄膜(振動、跳動)來產生聲音?……高速振動
4. 孔龍頭模型的原理是利用什麼來觀察到外界?……潛望鏡 (Periscope)
5. 可以用什麼方式來讓細吸管變成作簡易的吸管笛?……將前端剪成三角形

三、活動器材

孔龍頭模型(由鐵絲、報紙、保麗龍球、鏡片、紗布、輕黏土等組成)、

恐龍前肢模型(由彈簧、螺絲(帽)、棉線、塑膠水管、色鋁板、輕黏土等組成)

聲音模組粗吸管、細吸管、舊錄影帶磁條、鐵釘、木板等等組成。

四、活動內容(活動流程)

(一)恐龍化石與侏儸紀公園介紹

1. 恐龍化石的基本知識：
2. 戴上恐龍頭模型，利用模型的雙眼來觀看不同視野的外面世界。
3. 了解雙眼視野重疊後產生立體視覺的重要性。
4. 了解潛望鏡的原理與運用。

5. 探究與提問：

Q1：聽完恐龍頭骨的解說後，哪個部分最吸引你來探究呢？

A1：牙齒、顛嚙孔、恐龍的視野、其他想法。

Q2：說說看由恐龍頭模型的視角看出來有哪裡是不一樣的呢？

A2：物體影像經由鏡片反射後，雙眼重疊的部分減少，(甚至於完全沒有重疊)可以看到較寬廣的視野，但卻不容易得到明顯距離的立體深度視覺。

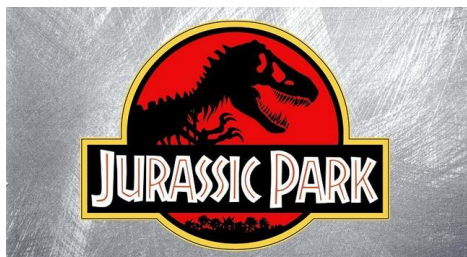
Q3：目前科學家推測哪種動物較接近恐龍的親戚？

A3：鳥類。因為(1)頭骨上還有對稱的顛嚙孔(2)只有鳥類與恐龍有『髓質組織』(鈣質來源)。其他類似的鱷魚、蜥蜴等爬蟲類都沒有此組織。

Q4：「侏儸紀公園」代表什麼呢

A4：(1)是一部想像的恐龍電影(2)侏儸紀是恐龍稱霸地球的時間點(3)是人類想要利用基因複製方式來重新誕生生活體恐龍的夢想。

模型、學生製作過程、成品



圖片來源：

<https://zh.wikipedia.org/wiki/%E6%9A%B4%E9%BE%8D%E5%B1%AC>





(二)利用恐龍前肢模型來模擬抓取獵物的動作

1. 認識連桿傳動裝置的原理。
2. 了解手指施力後，延伸出的力量會衰減的原理。
3. 知道恐龍的前肢相關知識。

4. 探究與提問：

Q1： 恐龍前肢模型的連桿傳動裝置利用到那些材料呢？

A1： 由彈簧、螺絲(帽)、棉線、塑膠水管、色鋁板、輕黏土等組成。

Q2： 恐龍前肢的功能是？

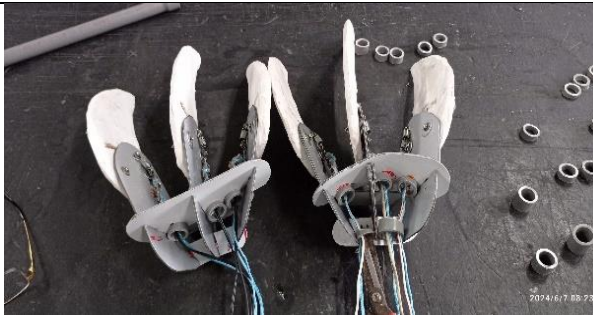
A2：(目前的主觀推論)簡單的固定獵物用。

Q3： 恐龍前肢的大小？

A3：厚度相當於人類的大腿，長度約 1 公尺，約可舉起 200 公斤的重量。

Q4： 恐龍前肢的機械原理是？

A4： 連桿傳動方式



(三)探究產生聲音的秘密

1. 以嘴巴來對準模型薄膜來吹出聲音。
2. 利用(粗吸管的狹縫+細吸管)來吹動模型的薄膜來產生聲音。
3. 利用 2. 來吹動鬆緊不同的薄膜後說說看兩次產生的聲音哪裡不同？
4. 探究與提問：

Q1：說一說聲音是怎麼製造出來的呢？

A1: 緊閉嘴巴快速吹出產生高速氣流，來讓薄膜產生來回快速振動。

Q2：薄膜拉緊與鬆弛時吹出來的聲音有什麼不同？

A2:(1)拉緊時可吹出高音(2)鬆弛時可吹出低音。

Q3：恐龍的叫聲可能有那些不同變化呢？

A3: 大小聲、高低音、不同的音色變化、時間的拉長等等。

Q4：利用給予的材料(細吸管)如何製作出最簡單的樂器？

A4: 細吸管前端剪成三角形，放入口中用力吹即可吹出聲音。

(四)通關標準

1. 幼兒：(1)能說出由恐龍頭模型中看到的景象。(2)能拉動恐龍前爪模型看到抓取動作。
2. 中低年級：(1)能整合出(組合)恐龍頭模型眼中看到的景象。(2)能拉動恐龍前爪模型兩次。能認真聽解爪教具的連桿動作原理。(3)能利用狹縫吸管來吹出聲音。
3. 高年級：(1)能利用恐龍頭模型的雙眼來說出字體正立或倒立、變大還是變小的差異。(2)能說明拉動恐龍前爪模型時的分解動作(連桿動作的原理)。(3)能判斷出吹出聲音的高低音來。

(五)闖關者自己動手做

1. 當雙眼視覺變成寬眼幅時(阿凡達的寬鼻樑)
2. 恐龍前爪模型需要加大抓取獵物幅度時如何修改連桿動作？
3. 能利用細吸管自製出簡易的吸管笛。

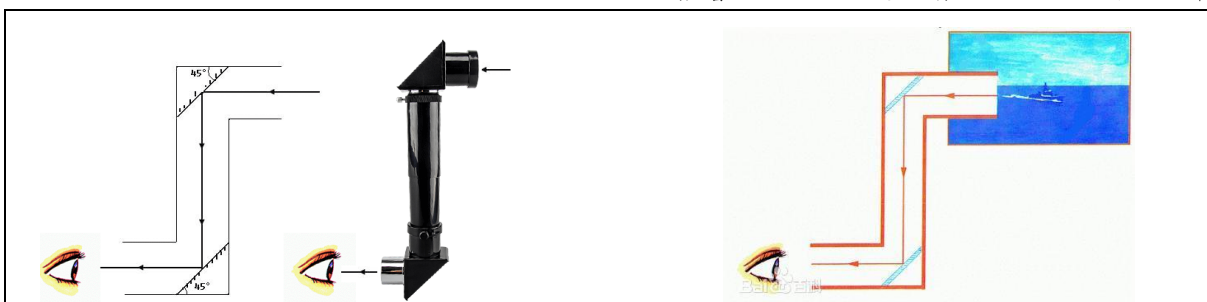
五、原理探討

(一) 潛望鏡 (Periscope)：是一種利用光線反射原理所製作的光學儀器，最常被用在潛水艇用以在水下觀察水面上的動靜。(適用於不同高度、角度來隱蔽觀測的工具)。

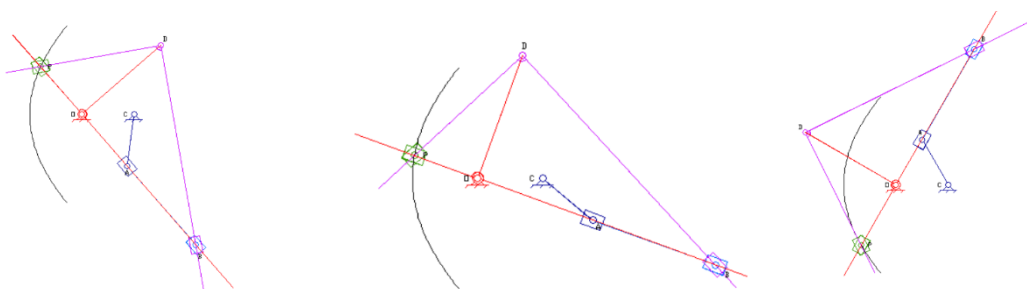
(二) 連桿傳動方式 (mechanical linkage)：利用二次曲線規(Crawford)，在兩平版上組裝一個靈活的旋轉軸來連接掌、爪兩平板，A孔為合併後的旋轉軸，B孔為爪平板的絞接軸與掌平板凹槽的的定位滑動，C孔為掌平板的絞接軸與爪平板的定位凹槽滑動處，BC兩孔的絞接軸以彈簧連結。(三轉軸位置為三角形的頂點)。

當施力向後拉動彈簧時爪平板會依定位凹槽來做下抓的動作，當施力消失時爪平板會依凹槽位置慢慢恢復瓜子張開的模式。(以爪抓取獵物的機械動作)。

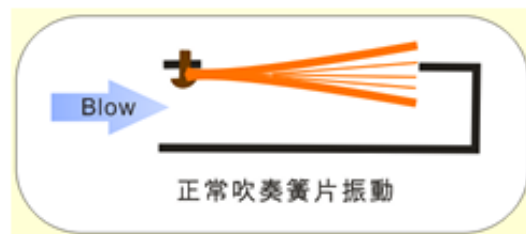
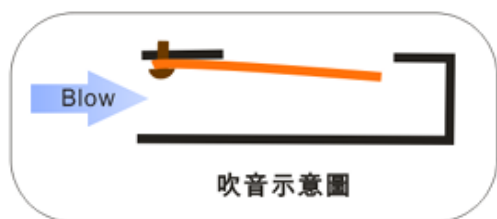
(三) 聲音產生的原理(Sound Generation)：利用高速氣流來讓前方的薄片產生來回的振動，並影響兩側的空氣跟著振動，便能產生聲音。



資料來源：<https://www.sgss8.net/tpdq/19014431>



資料來源：<https://zh.wikipedia.org/zh-tw/%E8%BF%9E%E6%9D%86%E6%9C%BA%E6%9E%84>



資料來源：<https://www.ntsec.edu.tw/science/detail.aspx?a=21&cat=100&sid=3289>

六、結合課程設計

- (一)康軒版本-五上 第二單元 探索聲光世界—(光有什麼特性與現象)(聲音的高低)
- (二)康軒版本-五下 第二單元 大地的奧秘—(化石)
- (三)康軒版本-六下 第一單元 簡單機械—(槓桿原理)

七、參考資料

1. <https://zh.wikipedia.org/zh-tw/%E5%8F%8C%E7%9C%BC%E8%A7%86%E8%A7%89>
(視野)(重疊視野)(立體視覺)
2. <https://knews.cc/science/ql1zlag.html> (顛顛孔)
3. <https://forum.gamer.com.tw/C.php?bsn=60433&snA=30644> (霸王龍)
4. <https://knews.cc/science/85ne9qg.html> (侏羅紀公園)
5. <https://knews.cc/news/8vvj88g.html> (恐龍的前肢)
6. <https://zh.wikipedia.org/zh-tw/%E6%81%90%E9%BE%99> (恐龍的頭部骨骼)
7. <https://lihkg.com/thread/183181/page/1> (化石與推測模型照片)
8. <https://lihkg.com/thread/240657/page/1> (顛骨與囁嚅孔的差別)
9. <https://www.sgss8.net/tpdq/19014431/> (潛望鏡原理)
10. <https://zh.wikipedia.org/zh-tw/%E8%BF%9E%E6%9D%86%E6%9C%BA%E6%9E%84>
11. <https://www.ntsec.edu.tw/science/detail.aspx?a=21&cat=100&sid=3289> (口琴簧片振動與氣流)
12. <https://zh.wikipedia.org/zh-tw/%E8%BF%9E%E6%9D%86%E6%9C%BA%E6%9E%84>(連桿)
13. <https://zh.wikipedia.org/zh-tw/%E8%BF%9E%E6%9D%86%E6%9C%BA%E6%9E%84>
(crawford 二次曲線規)

The 43rd Kaohsiung Primary and Junior High School Science Fair

學校名稱	Min Zu Elementary school
活動名稱	Jurassic Park—Exploring Dinosaurs
指導老師	劉晏企、焦恒永、黃佳媛、陳雅慈

一、Purpose

- (一) The light enters the vision either in a straight line or through reflection. We see an image of an object through the dinosaur's perspective.
- (二) Pull the spring to transfer kinetic energy through the linkage. We can observe the movement of the dinosaur's front paws by pulling the linkage device with the fingers.
- (三) When the air flow passes through the membrane quickly, it causes back and forth vibrations to produce sound. Use a straw with a narrow slit to blow on membranes with varying tension to create dinosaur-like sounds of different pitches.
- (四) Utilize dinosaur head and hand models for hands-on operation, allowing students to experience the differences between dinosaurs and humans in terms of visual, auditory, and tactile senses. This helps them understand evolutionary differences while fostering scientific literacy, knowledge, and inquiry skills.

二、Vocabulary and sentence pattern

(一) Vocabulary

dinosaur、tyrannosaurus rex(簡寫 T. rex)、vision)、overlap、head structure、temporal openings(infratemporal fenestra)、temporal bone、antorbital fenestra、forelimb、mechanical linkage、sound

(二) Sentence pattern

1. Through the eyes of blue-purple dinosaur head model, we can see the overlapping (or non-overlapping) images.
2. Which mechanical principle is used in the dinosaur forelimb model to achieve biomimetic movement?
3. The sound module uses high-speed airflow to make the membrane (vibrate or flutter) to produce sound.
4. What is the principle of the hole faucet model used to observe the outside world?
5. How can we turn a thin straw into a simple straw flute? (Cut the front end into a triangle)

三、Experimental Equipment

- (一) The dinosaur head model is made of iron wire、newspaper、styrofoam ball、lens、gauze、light clay etc.
- (二) The dinosaur forelimb model is made of spring、screw(nut)、cotton thread、plastic water pipe、color aluminum plate、light clay etc.
- (三) The sound module is made of thick straw、thin straw、old video tape magnetic strip、nails、Board etc.

四、Activities

(一) Dinosaur fossils and Jurassic Park introduction

1. The basic knowledge about dinosaur fossils.
2. Put on a dinosaur head model and use the model's eyes to see the outside world in different

perspectives.

3. To understand the importance of overlapping visual fields from both eyes in producing stereoscopic vision.

4. To understand the principle and application of periscopes.

5. Inquiry and questioning

Q1 : After listening to the explanation of the dinosaur skull, which part interests you the most for further exploration?

A1 : Teeth, temporal foramen, dinosaur vision, other thoughts.

Q2 : From the perspective of the dinosaur head model, what differences can you observe?

A2 : After the object's image is reflected through the lens, the overlapping area seen by both eyes is reduced (or even completely absent), allowing for a wider field of view, but making it difficult to perceive clear depth in stereoscopic vision.

Q3 : Which animal do scientists currently speculate is the closest relative to dinosaurs?

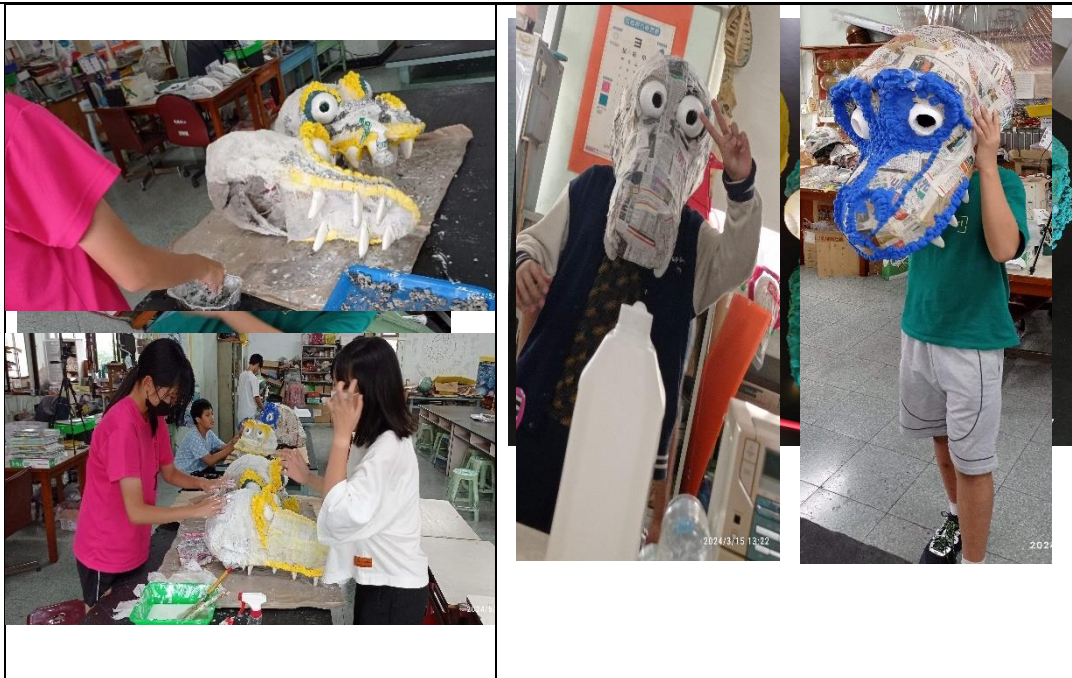
A3 : Birds. Because (1) There are symmetrical temporal openings on the skull. (2) Only birds and dinosaurs possess 'medullary tissue' (a source of calcium). Other similar reptiles such as crocodiles and lizards do not have this tissue.

Q4 : What does 'Jurassic Park' represent?

A4 : (1) It is an imagined dinosaur movie. (2) The Jurassic period is the time when dinosaurs dominated the Earth. (3) It is humanity's dream to use genetic cloning techniques to bring dinosaurs back to life.

模型、學生製作過程、成品





(二) Use the dinosaur forelimb model to simulate the action of grabbing prey.

1. Understand the principles of linkage transmission devices.
2. Understand the principle that the force exerted by the fingers diminishes as it extends outward.
3. Know about the forelimbs of dinosaurs.

4. Inquiry and questioning :

Q1 : What materials are used in the linkage transmission mechanism of a dinosaur forelimb model?

A1 : It is composed of springs, screws (caps), cotton threads, plastic water pipes, colored aluminum plates, light clay, etc.

Q2 : What is the function of dinosaur forelimbs ?

A2 : (The current subjective inference) It is primarily used for securing prey.

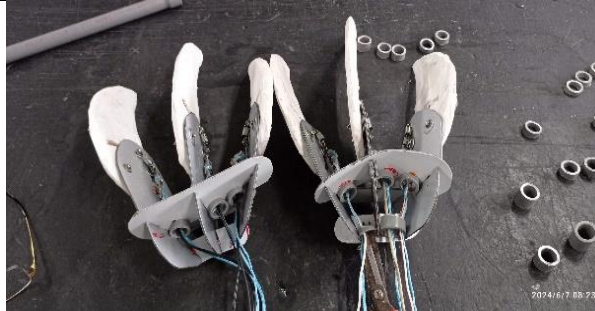
Q3 : What is the size of dinosaur forelimbs ?

A3 : The thickness is comparable to that of a human thigh, with a length of about 1 meter, and it can lift approximately 200 kilograms.

Q4 : What is the mechanical principle of dinosaur forelimbs ?

A4 : Linkage transmission mechanism.





(三) Discover the secrets behind sound

1. Use the mouth to align with the model's membrane to produce sound.
2. Utilize (slit of a coarse straw + a thin straw) to blow the membrane of the model to produce sound.
3. Use 2. to blow on membranes with different tensions and then describe the difference between the sounds produced in the first and second instances.
4. Inquiry and questioning :
 - Q1 : Explain how sound is produced.
 - A1 : Blow out quickly with your mouth closed to create a high- velocity airflow that causes the membranes to vibrate back and forth rapidly.
 - Q2 : What is the difference in sound when blowing on a tight membrane versus a loose one?
 - A2: (1)When tightened, a high pitch can be produced.
 - (2)When loose, a low-pitched sound can be produced.
 - Q3 : What variations might have existed in the sounds that dinosaurs made?
 - A3: Volume, pitch, different tonal variations, lengthening of the sound, and so on.
 - Q4 : How to create the simplest musical instrument using the provided materials (thin straws)?
 - A4: Cut the tip of the thin straw into a triangle and put it in your mouth to blow hard to make a sound.

(四) Pass standards

1. Child: (1) Be able to describe the scene seen through the model of the dinosaur's head model. (2) Be able to see the grabbing motion by pulling the model of the dinosaur's front claw.
2. Lower Middle and Lower Grades: (1) Be able to integrate (combine) the scene seen through the model of the dinosaur's head model. (2) Be able to pull the dinosaur front paw model twice. Be able to carefully listen to and understand the principle of the linkage mechanism in the claw teaching tool. (3) Be able to use a slit straw to produce sound.
3. Upper grade: (1) Be able to use the dinosaur head model's eyes to describe the differences in whether the text is upright or inverted, enlarged or reduced. (2) Be able to explain the breakdown of movements when pulling the dinosaur front claw model (the principle of the linkage mechanism). (3) Be able to determine the pitch of the sound produced.

(五) DIY experiment

1. When binocular vision becomes wide-angled (like the wide nose bridge of an Avatar).
2. How should the linkage mechanism be adjusted in the dinosaur front claw model to increase the grasping range for catching prey?
3. Be able to make a simple straw flute by using a thin straw.

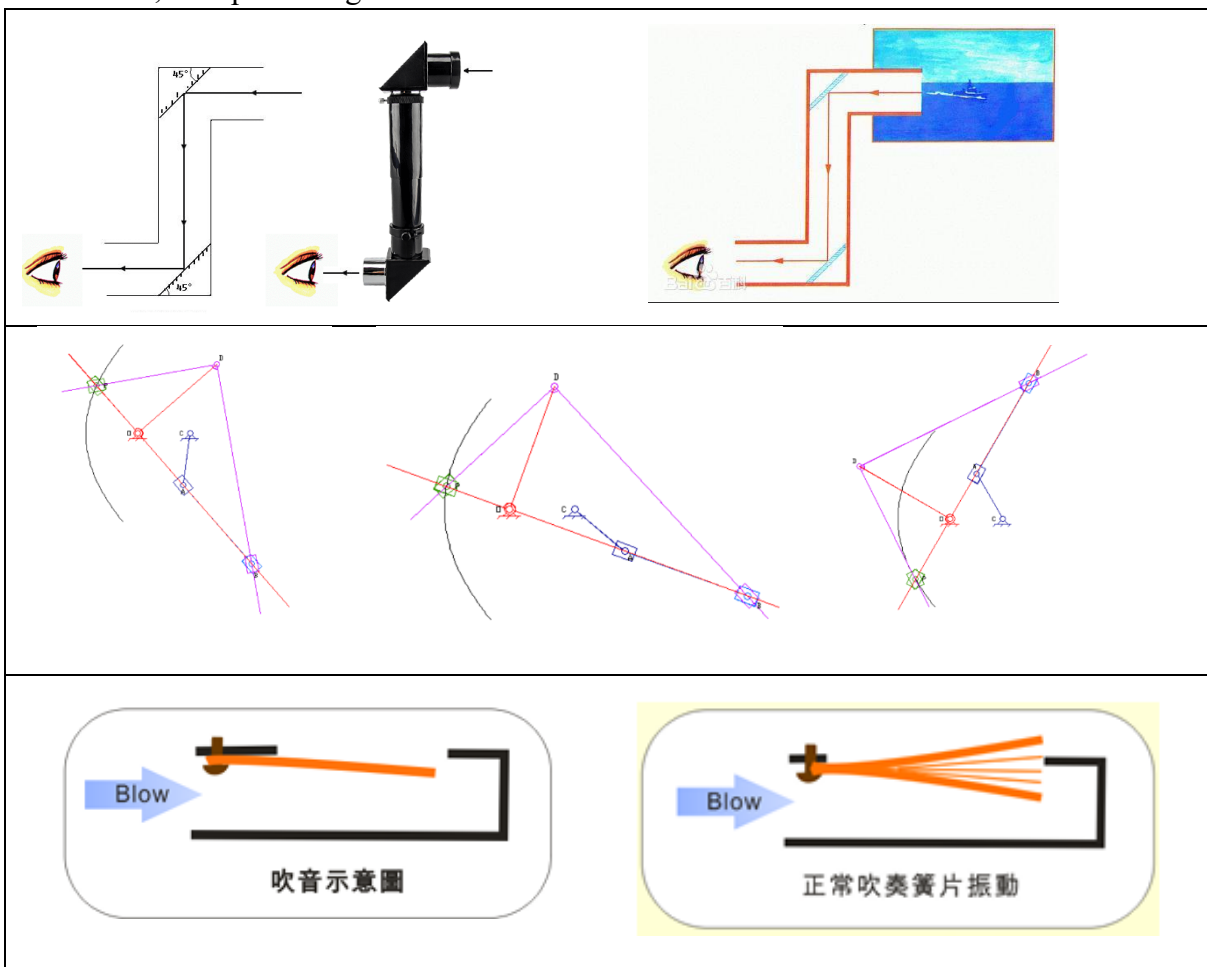
五、Principle

(一) Periscope : It is an optical instrument made by using the principle of light reflection, and is most commonly used in submarines to observe movement on the surface of the water underwater. It is a tool for covert observation at different heights and angles.

(二) Mechanical linkage : Using a conic section guide (Crawford), a flexible rotating axis is assembled between two flat plates to connect the palm and claw plates. Hole A serves as the rotating axis after assembly, hole B is the hinge axis of the claw plate and allows for sliding in the groove of the palm plate for positioning, and hole C is the hinge axis of the palm plate that slides in the positioning groove of the claw plate. The hinge axes of holes B and C are connected by a spring. (The three rotating axes form the vertices of a triangle.)

When force is applied to pull the spring backward, the claw plate will perform a downward grasping motion based on the positioning groove. When the force is released, the claw plate will gradually return to the open position according to the groove. (This describes the mechanical motion of the claw grasping prey.)

(三) The principle of sound production : The principle of sound production: Using high-speed airflow to create back-and-forth vibrations in the front sheet, which then causes the air on both sides to vibrate, thus producing sound.



六、Integrated curriculum design

- (一)康軒版本-五上 第二單元 探索聲光世界—(光有什麼特性與現象)(聲音的高低)
- (二)康軒版本-五下 第二單元 大地的奧秘—(化石)
- (三)康軒版本-六下 第一單元 簡單機械—(槓桿原理)

七、References

1. <https://zh.wikipedia.org/zh-tw/%E5%8F%8C%E7%9C%BC%E8%A7%86%E8%A7%89>
2. <https://kknews.cc/science/qllzlag.html>
3. <https://forum.gamer.com.tw/C.php?bsn=60433&snA=30644>
4. <https://kknews.cc/science/85ne9gg.html>
5. <https://kknews.cc/news/8vuj88g.html>
6. <https://zh.wikipedia.org/zh-tw/%E6%81%90%E9%BE%99>
7. <https://lihkg.com/thread/183181/page/1>
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9. <https://www.sgss8.net/tpdq/19014431/>
10. <https://zh.wikipedia.org/zh-tw/%E8%BF%9E%E6%9D%86%E6%9C%BA%E6%9E%84>
11. <https://www.ntsec.edu.tw/science/detail.aspx?a=21&cat=100&sid=3289>
12. <https://zh.wikipedia.org/zh-tw/%E8%BF%9E%E6%9D%86%E6%9C%BA%E6%9E%84>
13. <https://zh.wikipedia.org/zh-tw/%E8%BF%9E%E6%9D%86%E6%9C%BA%E6%9E%84>