Multilevel Leadership Network for SDL Innovation to Advance STEM Development (SDLS-MLN)

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12 Jun 2018
SDLS-MLN projects

Multi-level Leadership Network for SDL Innovation to Advance STEM Development

http://sdls-mln.cite.hku.hk/
Project Introduction: Foci

• To enhance teachers’ understanding of the guiding and underlying principles of STEM education and self-directed learning (SDL)

• To engage students in STEM learning with SDL approach so as to develop their 21st century skills

• To scale up innovative practices through multi-level cluster networks
Project Introduction: Modes

Regular monthly Project (cluster) Meetings

Co-planning with individual school teams (onsite school based support)

Planning (communicate with consultants)

Revise planning (communicate with consultants)

(Open) Lesson observations

Debriefing
Objectives for today’s workshop

• To understand of the guiding and underlying principles of interdisciplinary STEM education and self-directed learning (SDL)
• To experience learning processes in SDL in a STEM activity
• To see how students in our project have engaged in interdisciplinary STEM learning with SDL approach so as to develop their 21st century skills
What is self-directed learning?

https://www.mentimeter.com/s/edfdafa50ecbc5aef0624095d2aa6be8/2848be21ce55/edit

Code: 19 42 62
What is STEM?

https://www.mentimeter.com/s/edfdafa50ecbc5ae0624095d2aa6be8/2848be21ce55/edit

Code: 19 42 62
Starter: Experiencing a part of STEM learning (15 mins)
Starter: Experiencing a part of STEM learning

Question: Which solar panel has the best performance?
Inquiry Question: How to know which solar panel has the best performance?

Task: Plan an experiment to fairly compare which solar panel performs better.
Starter: Experiencing a part of STEM learning

**Inquiry Question:** How to know which solar panel has the best performance?

Task: Plan an experiment to fairly compare which solar panel performs better.
Inquiry Question: How to know which solar panel has the best performance?

Task: Plan an experiment to fairly compare which solar panel performs better.
Starter: Experiencing a part of STEM learning

Inquiry Question: How to know which solar panel has the best performance?

Task: Plan an experiment to fairly compare which solar panel performs better.

My result is… Reliable…? What I should be aware of?
Inquiry Question: **How to know** which solar panel has the best performance?

Task: Plan an experiment to fairly compare which solar panel performs better.
Key concepts of the MLN project

- Self-directed learning
- Integrated STEM (interdisciplinary)
- Multi-level leadership network (Architectures for learning)

http://sdls-mln.cite.hku.hk/en/introduction/
What is self-directed learning?

A part of it is about...

Sort of...

Part of...

Students have pre-lesson tasks. After the lesson, students have to learn something online.
SDL 5 essential components

- Revision
- Goal Setting
- Self-evaluation
- Self-Planning
- Self-monitoring
Goal Setting (設定目標)

Students identify own learning goals & learning activities
層次一 (Level 1) Teacher sets the goal for students.
老師為學生制訂目標：設計及製作一隻航行的快又穩的太陽能船。

層次二 (Level 2) Students choose their goal.
在下雨天的情景下，學生挑選最想儘快弄乾的物件作爲任務目標。

目標：綜合和應用科學與科技的知識與技能，利用再生能源解決化石燃料在使用時產生的空氣污染問題。
Goal-setting

層次三 (Level 3) Students set goals by themselves.

應用Micro:bit研發加強長者活動能力的 電動游戲機
Self-planning (自我規劃)

Students regulate and plan for the detailed decisions and arrangements associated with own learning, such as planning, creating outline of schedule.
層次一 (Level 1) Teacher offers materials for students.

學生根據老師所提供的物料選擇相應的器官

層次二 (Level 2) Teachers offers guideline for students to choose materials.

學生自行選擇適用的物料以製作太陽能船
層次三 (Level 3) Students decide their own materials, experimental procedure and work allocation by themselves.

學生自行定義乾衣方式及所需物料，設計流程，並根據物料進行小組分工
Self-monitoring (自我監控)

- Students self-manage their own time
- Students monitor own repertoire of learning strategies
- Students adjust own learning pathway as they progress
學生根據提供的探究清單，實施探究計劃以進一步優化麥皮蟲的生活環境。

Teacher provides checklist for students to follow up their implementation, and therefore ensures that all students can get involved in the collaborative learning and the learning process gets efficient.

<table>
<thead>
<tr>
<th>The factor investigated in your group: Moist on the floor in the house</th>
<th>The factor investigated in your group: Colour of the light in the house</th>
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<tbody>
<tr>
<td>Procedures: 1. Spray the filter paper (which is half of the size of the floor in the box) with water. 2. Wipe it briefly to remove water in excess. 3. Put it on one side of the box. 4. Put 10 mealworms in the box as evenly as possible. 5. Take a 5-min record, jot down the distribution of the mealworms in every 1 min. 6. Take a photo of your house (focusing on the distribution of mealworms on both sides) at the 5th min and upload to the PowerLesson. 7. Do the calculation on the worksheet to find the average percentage of mealworms distributed in moist surface versus dry surface. 8. Repeat steps 1-7 twice using a new set of 10 mealworms in each trial.</td>
<td>Procedures: 1. Cover half of the ceiling of your box with three layers of red glassine (紅玻璃紙). 2. Put the box under the table lamp, adjust the position of the lamp to make sure the shadow of the glassine is in the middle of the box. 3. Put 10 mealworms into the box as evenly as possible. 4. Take a 5-min record, jot down the distribution of the mealworms in every 1 min. 5. Take a photo of your house (focusing on the distribution of mealworms on both sides) at the 5th min and upload to the PowerLesson. 6. Do the calculation on the worksheet to find the average percentage of mealworms distributed in blue light versus white light. 7. Repeat steps 1-5 using blue and green glassine respectively, and using a new set of 10 mealworms in each trial.</td>
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Reminder: totally 3 photos (1 in each trial) will be uploaded onto PowerLesson for each group in this part.

Reminder: totally 3 photos (1 in each trial) will be uploaded onto PowerLesson for each group in this part.

Today's Objective – Building a house for your mealworms

Procedures: 1. Develop a house by integrated the favourable conditions concluded by your fellow classmates. 2. Put 10 mealworms in your developed house. 3. Wait for 5 mins, take a photo (especially when mealworms leave the house) and upload to PowerLesson. 4. Record the number of mealworms stayed / left in your house.
層次二 (Level 2)

學生根據老師工作紙的指示，對材料進行稱重，進行實驗並記錄分貝數
Students developed check list based on guideline from teacher.
層次三 (Level 3)

學生經過討論后制定出一份監控小組探究活動進程的清單，給實踐活動的觀察結果提供憑證。Students follow their original plans, take in charge of their own execution, and take real-time records of each trial.
Self-evaluation (自我評價)

- Students are aware of the assessment criteria
- Students critically evaluate work according to set criteria
層次一 (Level 1) Students evaluated their products based on criteria offered by teachers.

學生根據老師提供的評估量表對自製指尖陀螺進行評價

層次二 (Level 2) Students discuss with teacher the assessment criteria and evaluated their products.

學生分析老師提供的不同太陽爐的資訊，在老師的引導下得到太陽爐的評判準則，並根據準則對自製太陽爐進行評分
層次三 (Level 3) Students set the criteria by themselves and evaluated both the processes and products.

學生自行制定隔音耳塞評量準則並對不同物料進行評價，同時在iLAP上進行投票。
Revision (自我修訂)

• Students revise their work based on the feedback received from their teacher or peers at various stages.
• Students reflect on their own learning and apply what they have learnt to new contexts.
層次一 (Level 1)

Based on peers' and teachers' feedback, students reflected on their work and proposed some solutions.

學生根據老師以及同學的回饋提出改良方式

層次二 (Level 2)

Based on peers' and teachers' feedback, students revised and re-submitted their works.

學生根據測試中老師以及同學的回饋，對作品進行改良
層次三 (Level 3)
Students revised their goals and inquiry process to rebuild their products.

學生不斷改變物料的重量進行測試，以達到減少更多分貝的效果

學生在自製酸堿指示劑課堂的延伸活動：製作星空特飲中，根據實驗結果不斷改進製作方式
Self-directed learning (SDL)

SDL ≠ Self-learning alone after the lesson

放手 ≠ 放

LET GO ≠ Let them go away
Reflection on the HANDS-ON activity

Discussion: What self-directed learning opportunities (components) are provided in the HANDS-ON activity?
Key concepts of the MLN project

- Self-directed learning

Integrated STEM (interdisciplinary)

- Multi-level leadership network (Architectures for learning)
Reflection on the HANDS-ON activity

Discussion: What S.T.E.M knowledge and skills are about to be integrated in the HANDS-ON activity or its subsequent activity?
In a project workshop, we have similar brainstorming session for teachers....

Possible S.T.E.M. elements (for primary students) 3 min

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In a project workshop, we have similar brainstorming session for teachers....
Solar car (P5)

The implementation....
Use of e-learning
Student achievements in our project
A Curriculum Example (Primary)

Grade: Primary 6

Subject: General studies

Topic: Simple mechanic --- Automata

No. of Lessons: 4
Self-directed learning (SDL)

Goal Setting

Self-planning

Self-Monitoring

Revision

Self-Evaluation
STEM

Science
- 簡單機械 Simple mechanic (槓桿、滾子、齒輪等)
- 聲光電的元素 Sound, Light, Electricity

Technology
- Video recording, photo taking;
- ILAP, Online discussion;

Engineering
- Design the automata
- Make and revise the automata

Mathematics
- Costs
- Size and number of the wheels
Grade: S 3
Subject: ICT
Topic: 應用Micro:bit研發加強長者活動能力的電動遊戲機
No. of Lessons: 4 lessons (70 mins/class)
Self-directed learning (SDL)

Goal Setting

Self-planning

Self-Monitoring

Self-Evaluation

Revision
STEM

Science
- 簡單機械 mechanic
- 聲光電的元素 Sound, Light, Electricity

Technology
- ILAP, Online discussion;
- Micro:bit

Engineering
- Design, make and revise the product

Mathematics
- Size
- Budget
Linking classroom practice to the community
Innovation
SDLS & MLN projects

Sdls.cite.hku.hk
Thank you!